



US Department of Agriculture



April 12, 2016

Glenn R. Bethel

USDA Remote Sensing Advisor

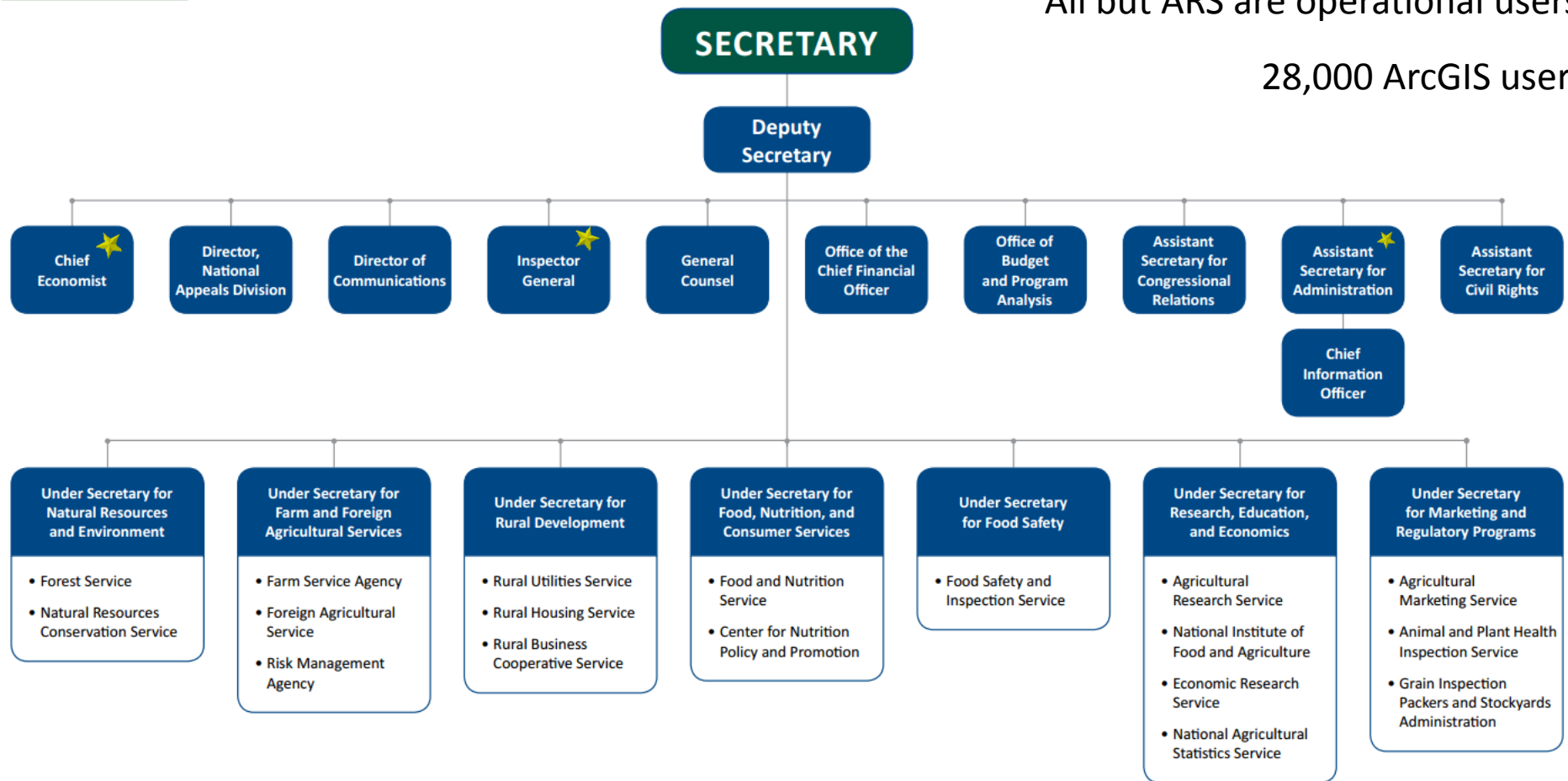
Civil Air Patrol,
Red River, TX



11 + USDA Agencies use imagery

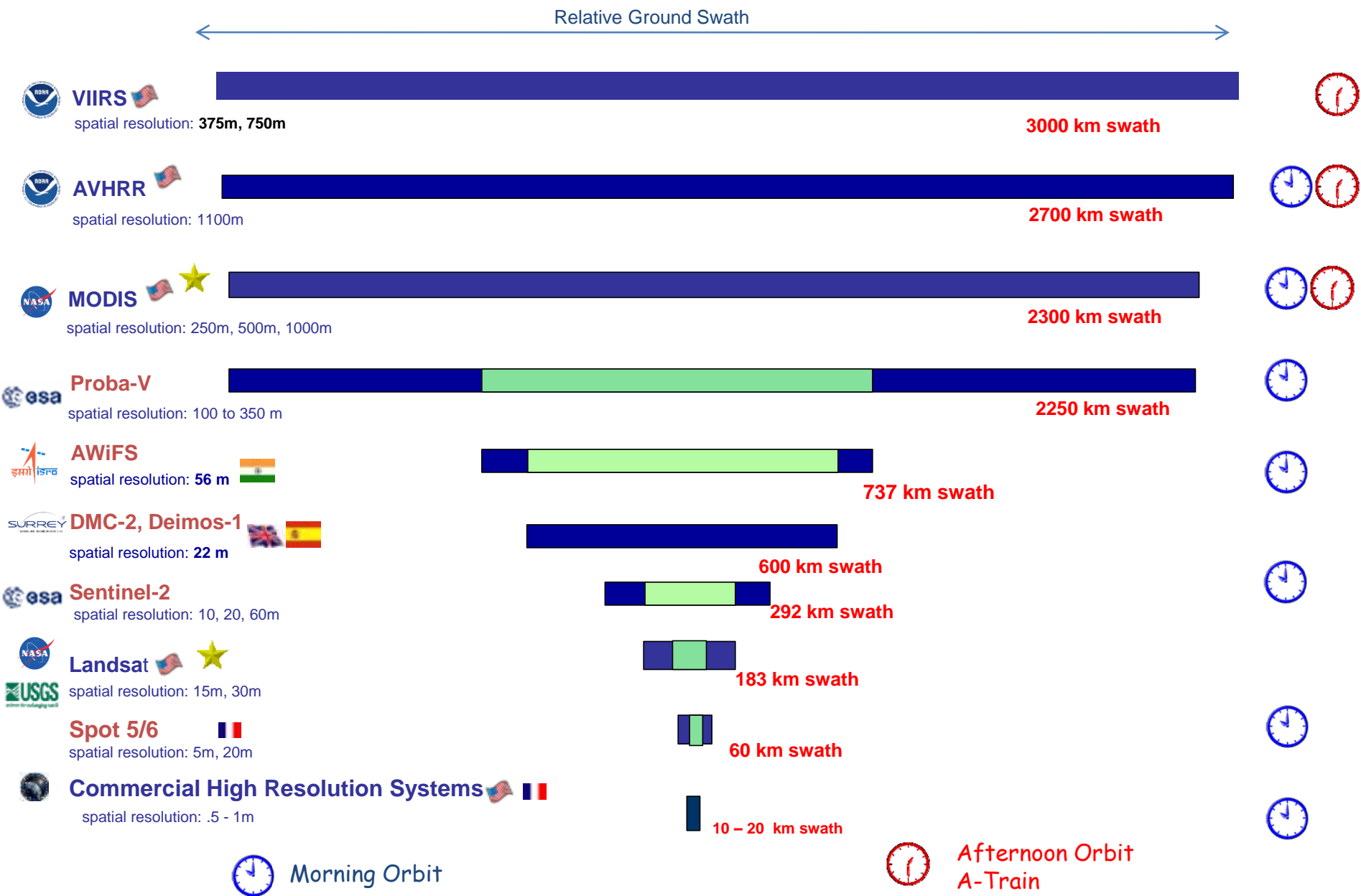
All but ARS are operational users

28,000 ArcGIS users

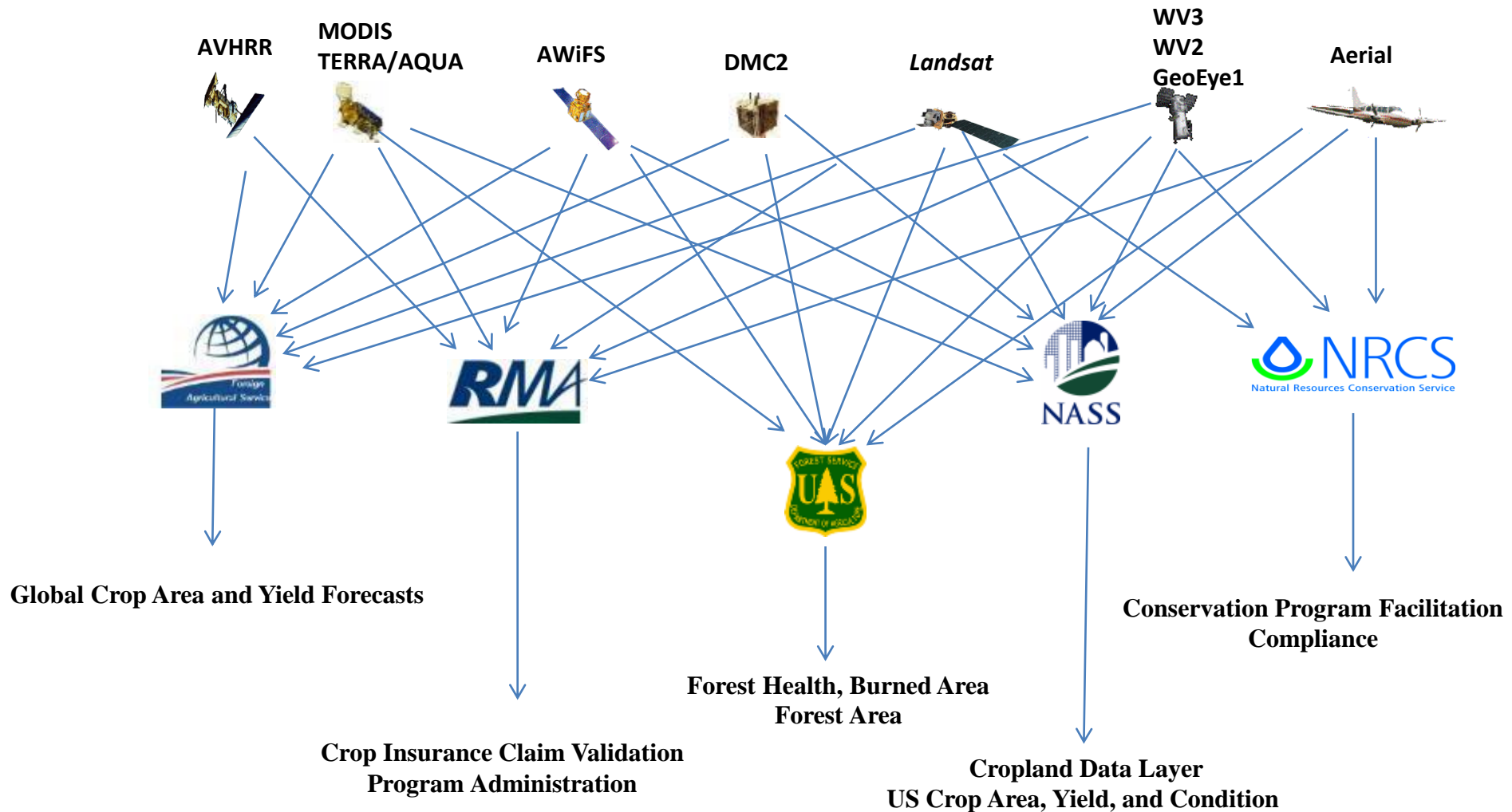




USDA Vegetation Monitoring Satellites



Agencies combine multiple sources for operational vegetation monitoring applications





Requirements for Operational Use

- **Reliable Data Streams**
 - The more daily coverage the better.
 - Process multiple satellite sensors to mitigate issues if one sensor fails.
 - Purchase licenses from foreign and commercial satellites to augment the US Earth observation portfolio.
- **Timely**
 - Minimize the time from acquisition to fully processed and ready to use.
 - One hour to maximum of 72 hours for imagery, next day for weather.
- **Time Series (Interfaces to collect and exploit multi-temporal imagery)**
 - Imagery → Day to day, ... Month to Month Year to Year, current conditions related to analog year
 - Image derived products (NDVI)
- **Imagery Ready to Use**
 - Calibrated / Cross Calibrated between sensors
 - GIS Ready, No additional processing required
 - Ortho-Corrected for pixel level change detection
 - Use either surface reflectance or top of atmosphere corrections
- **Storage!**
 - Ingesting Sentinel-2 imagery is a challenge.



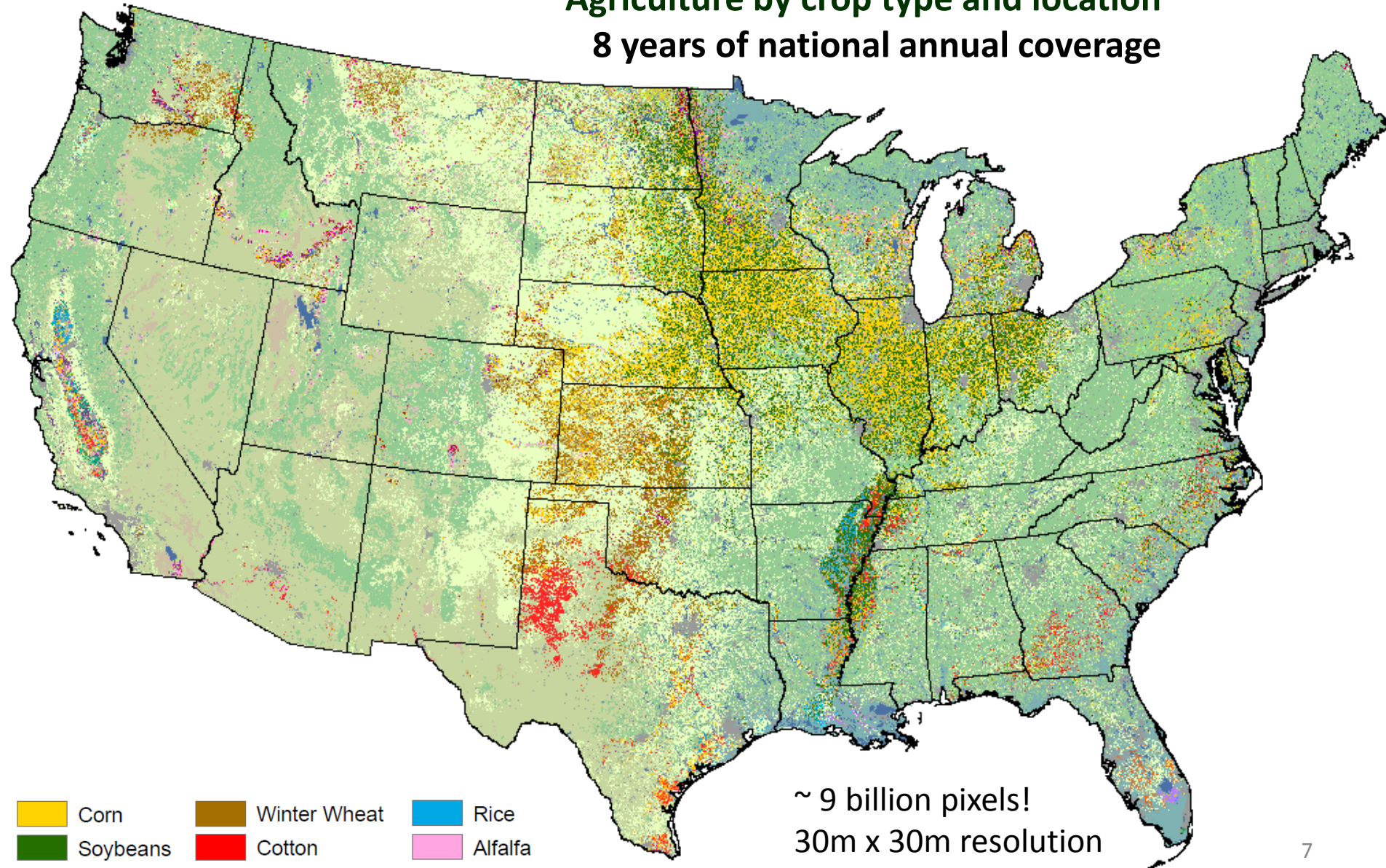
Major Agency Applications

- Administering Farm and Conservation Programs
 - Use a 1 meter or better image base
- US Crop Mapping and Monitoring
 - Area, yield, production, and condition all crops by field
- Forests
 - Health
 - Wildland Fires
 - Conservation / Carbon
- Monitoring for Compliance / Investigating Farm Program Fraud
 - Agencies
 - Office of Inspector General
- Global Crop Monitoring
 - Area, Yield, Production, and Condition by crop by country

Cropland Data Layer



Agriculture by crop type and location
8 years of national annual coverage



253 Crop Categories

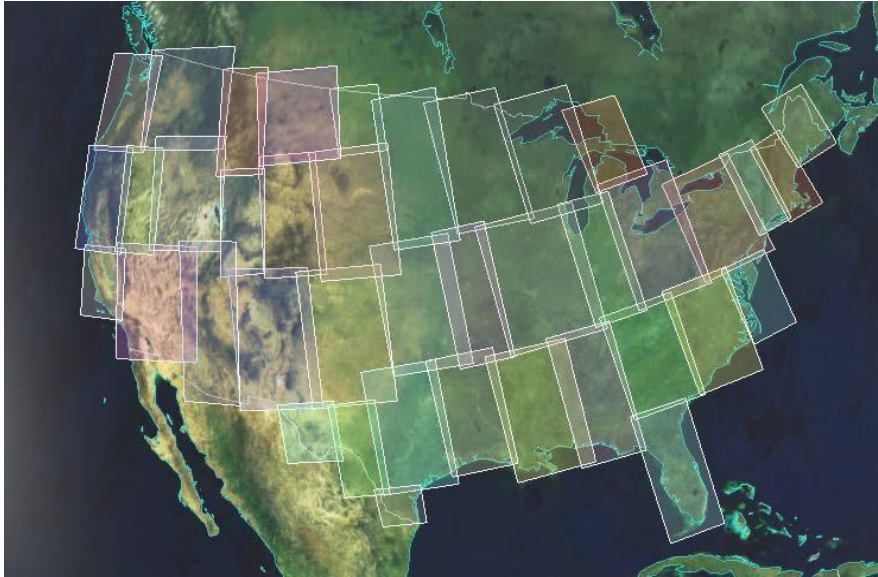


1	Corn	41	Sugarbeets	73	Other Tree Fruits	227	Lettuce
2	Cotton	42	Dry Beans	74	Pecans	228	Cucumbers
3	Rice	43	Potatoes	75	Almonds	229	Pumpkins
4	Sorghum	44	Other Crops	76	Walnuts	230	Lettuce/Durum Wht
5	Soybeans	45	Sugarcane	77	Pears	231	Lettuce/Cantaloupe
6	Sunflower	46	Sweet Potatoes	80	Other Non-Tree Fruit	232	Lettuce/Upland Cotton
10	Peanuts	47	Misc. Veggies. & Fruits	92	Aquaculture	233	Lettuce/Barley
11	Tobacco	48	Watermelons	204	Pistachios	234	Durum Wht/Sorghum
12	Sweet Corn	49	Onions	205	Triticale	235	Barley/Sorghum
13	Pop. or Orn. Corn	50	Pickles	206	Carrots	236	WinWht/Sorghum
14	Mint	51	Chick Peas	207	Asparagus	237	Barley/Corn
21	Barley	52	Lentils	208	Garlic	238	WinWht/Cotton
22	Durum Wheat	53	Peas	209	Cantaloupes	239	Soybeans/Cotton
23	Spring Wheat	54	Tomatoes	210	Prunes	240	Soybeans/Oats
24	Winter Wheat	55	Caneberries	211	Olives	241	Corn/Soybeans
25	Other Small Grains	56	Hops	212	Oranges	242	Blueberries
26	Dbl. Crop WinWht/Soy	57	Herbs	213	Honeydew Melons	243	Cabbage
27	Rye	58	Clover/Wildflowers	214	Broccoli	244	Cauliflower
28	Oats	59	Sod/Grass Seed	216	Peppers	245	Celery
29	Millet	60	Switchgrass	217	Pomegranates	246	Radishes
30	Speltz	61	Fallow/Idle Cropland	218	Nectarines	247	Turnips
31	Canola	62	Pasture/Grass	219	Greens	248	Eggplants
32	Flaxseed	66	Cherries	220	Plums	249	Gourds
33	Safflower	67	Peaches	221	Strawberries	250	Cranberries
34	Rape Seed	68	Apples	222	Squash	251	Corn - Non-Irrigated
35	Mustard	69	Grapes	223	Apricots	252	Soybean - Non-Irrigated
36	Alfalfa	70	Christmas Trees	224	Vetch	253	WinWheat - Non-Irrigated
37	Other Hay	71	Other Tree Nuts	225	WinWht/Corn		
38	Camelina	72	Citrus	226	Oats/Corn		

Cropland Data Layer Inputs

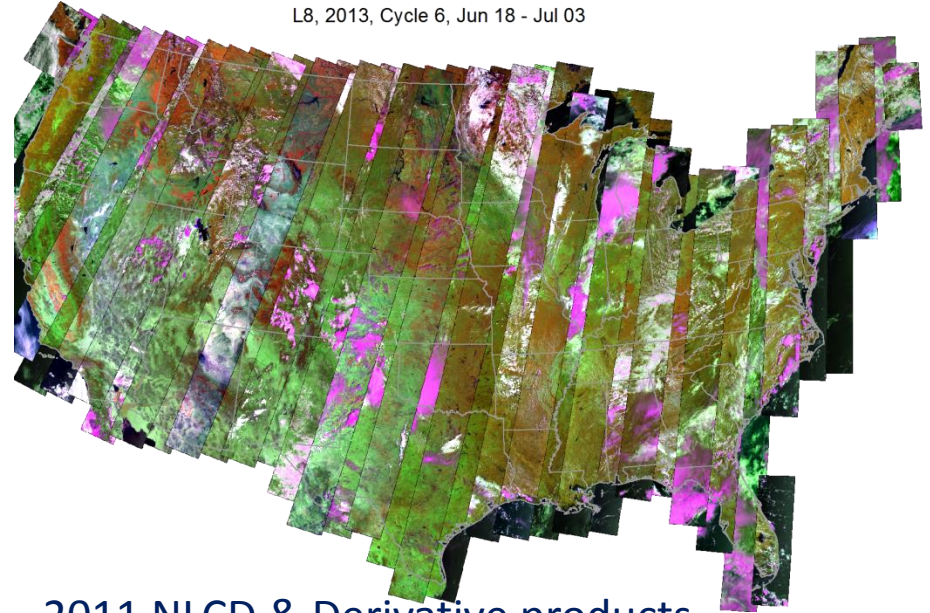


Satellite Imagery – DMC Deimos-1 & UK2

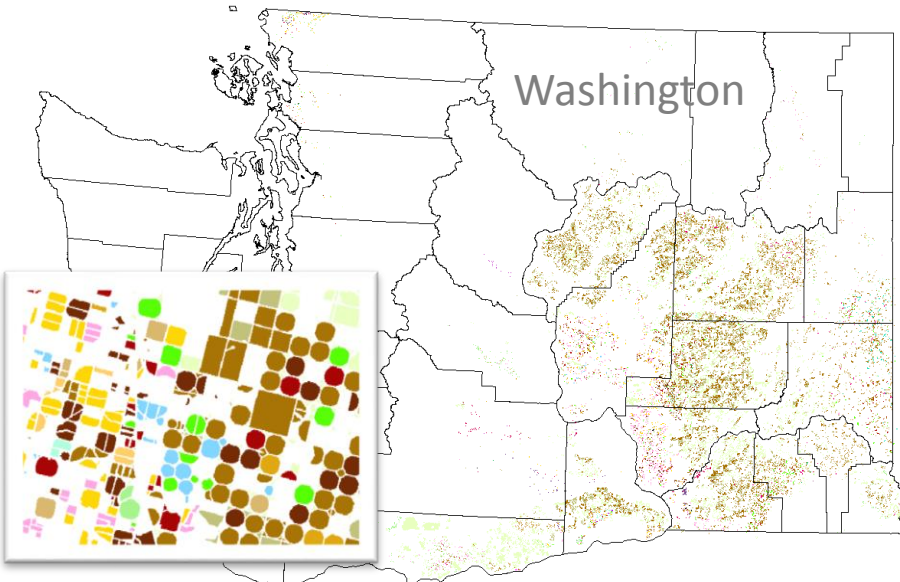


Satellite Imagery – Landsat 8

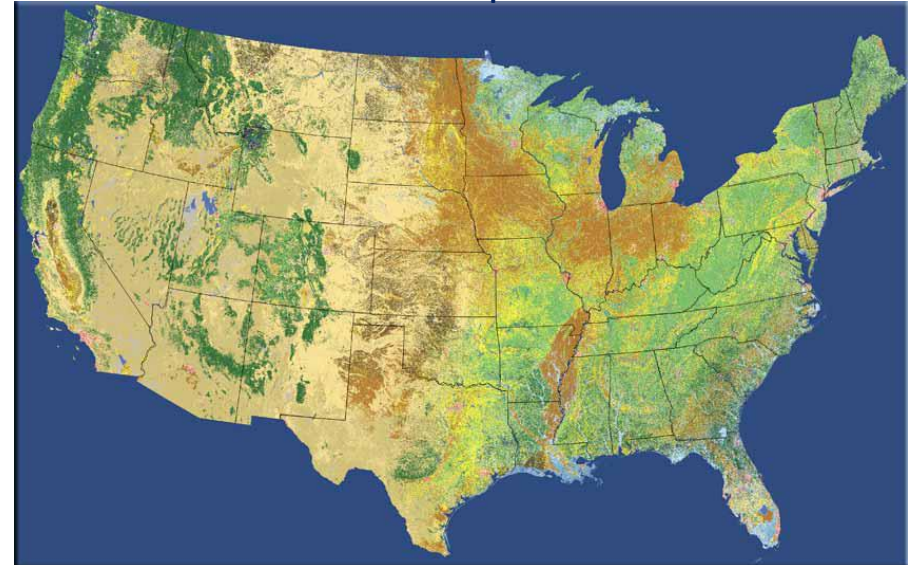
L8, 2013, Cycle 6, Jun 18 - Jul 03



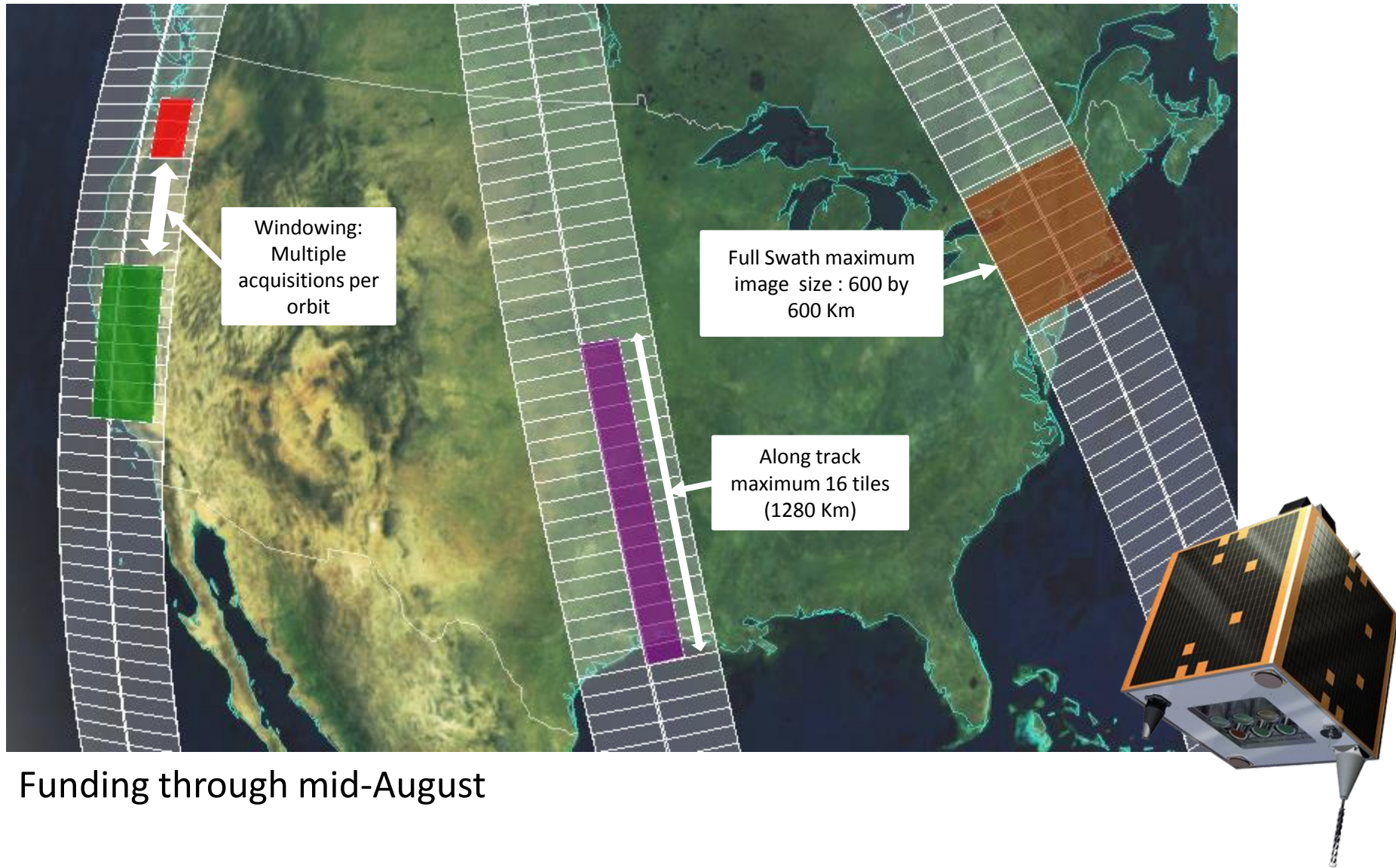
Farm Service Agency: Common Land Unit



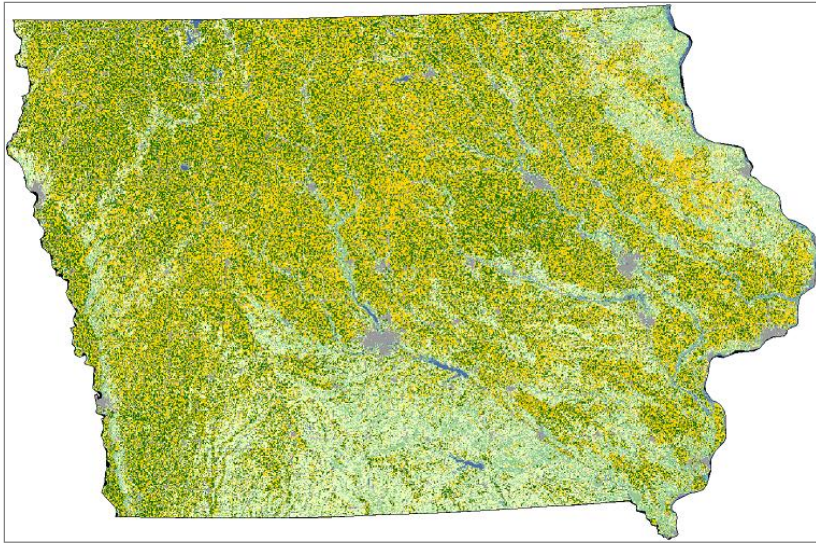
2011 NLCD & Derivative products



Deimos-1/UK2 Satellite Tasking

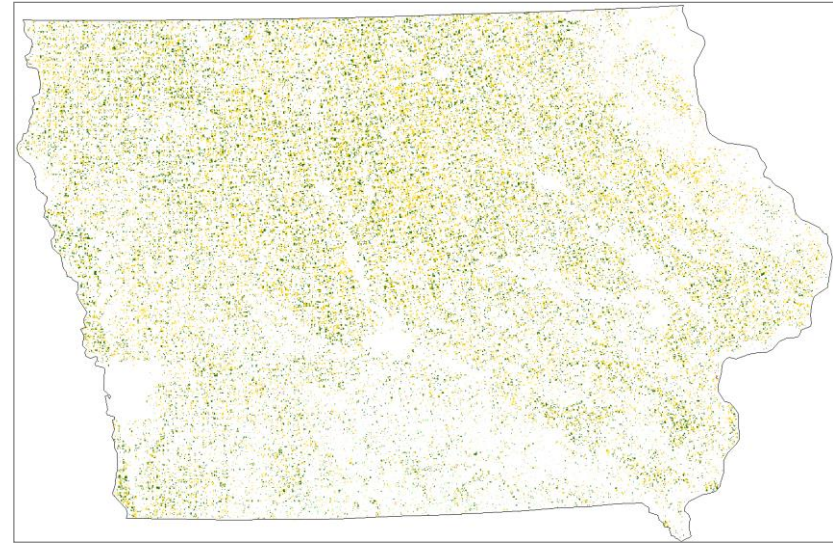


Validating CDLs



Cropland Data Layer

versus



Reserved Farm Data

30% saved for validation

Compare

Classified pixels from CDL

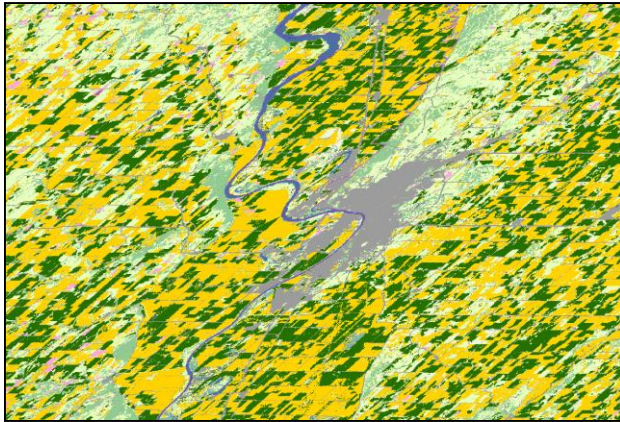
Known pixels, not used for classifying imagery, from FSA

Measure

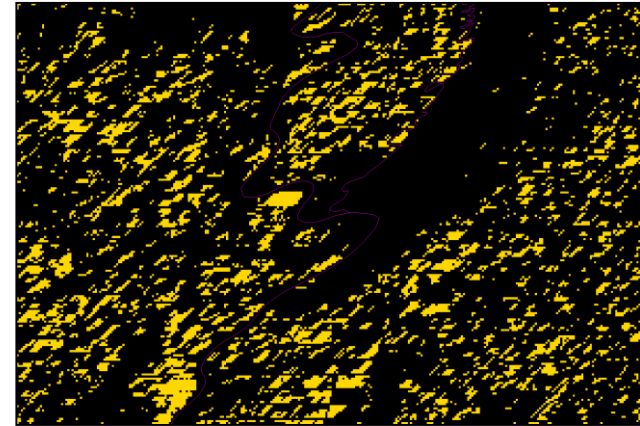
Producer Accuracy & Errors of Omission - % of pixels from category missing

User Accuracy & Errors of Commission - % of pixels from category that are over classified

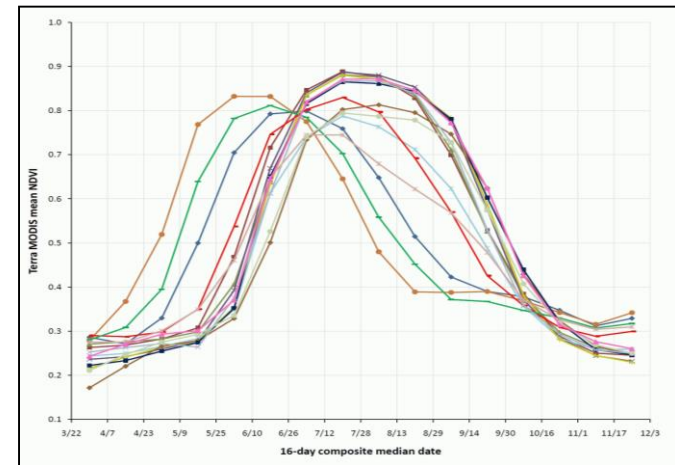
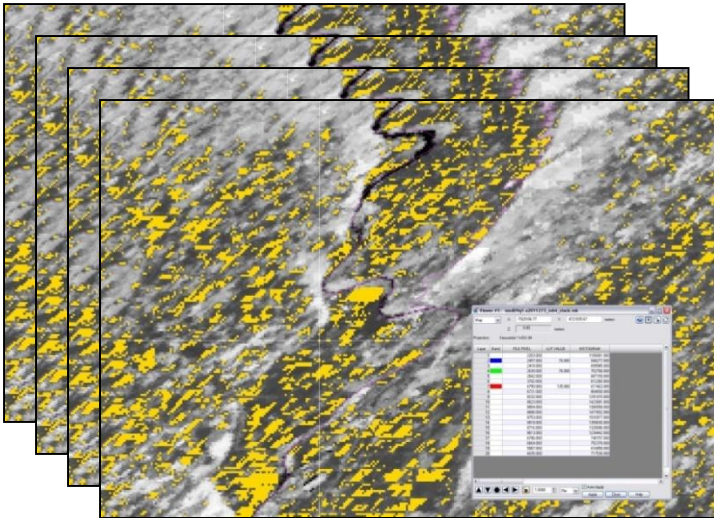
Intersecting of crop “mask” with time-series of MODIS data



CDL

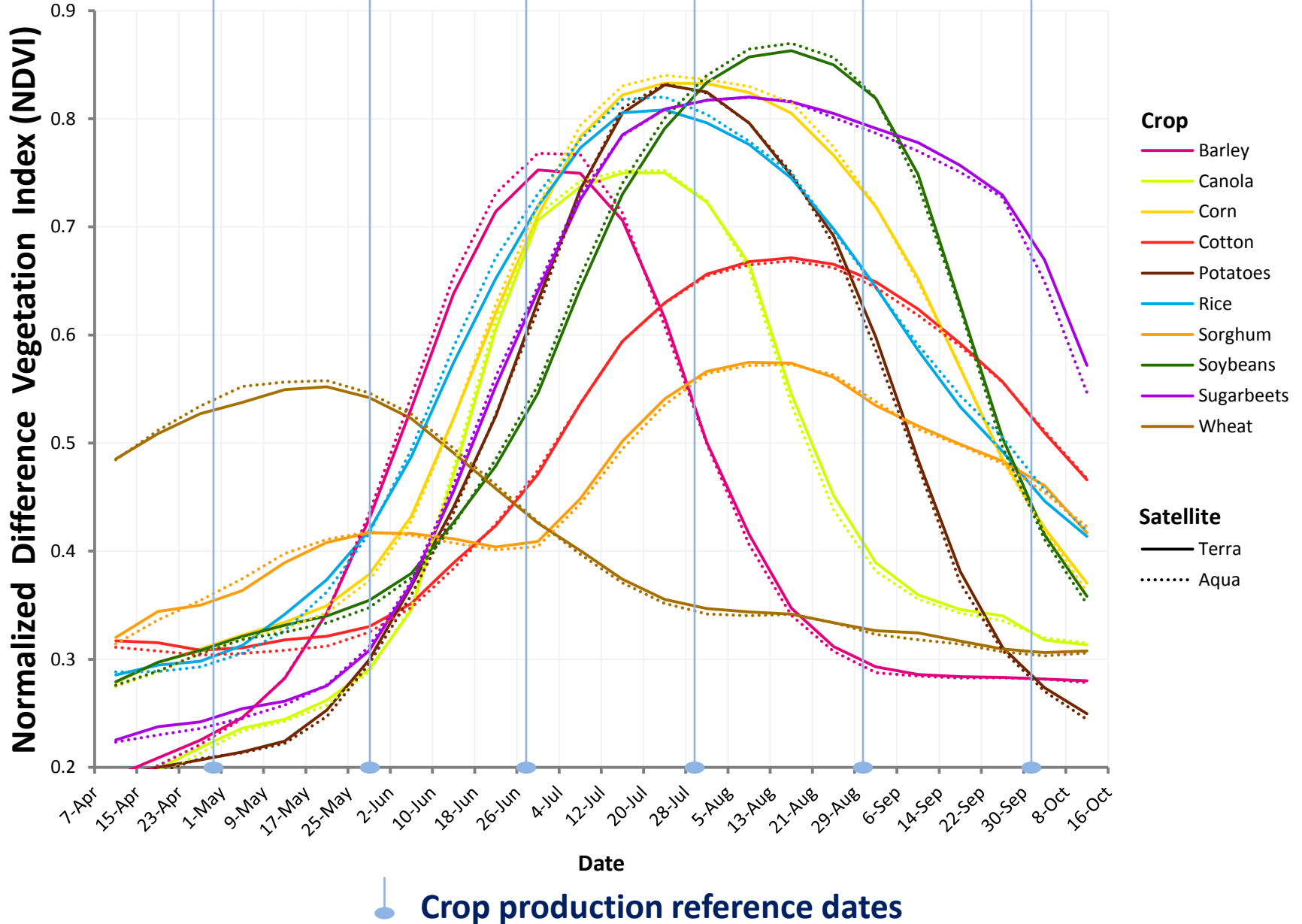


Isolate crop of interest



Intersect crop mask with MODIS time series and then spatially average those pixels

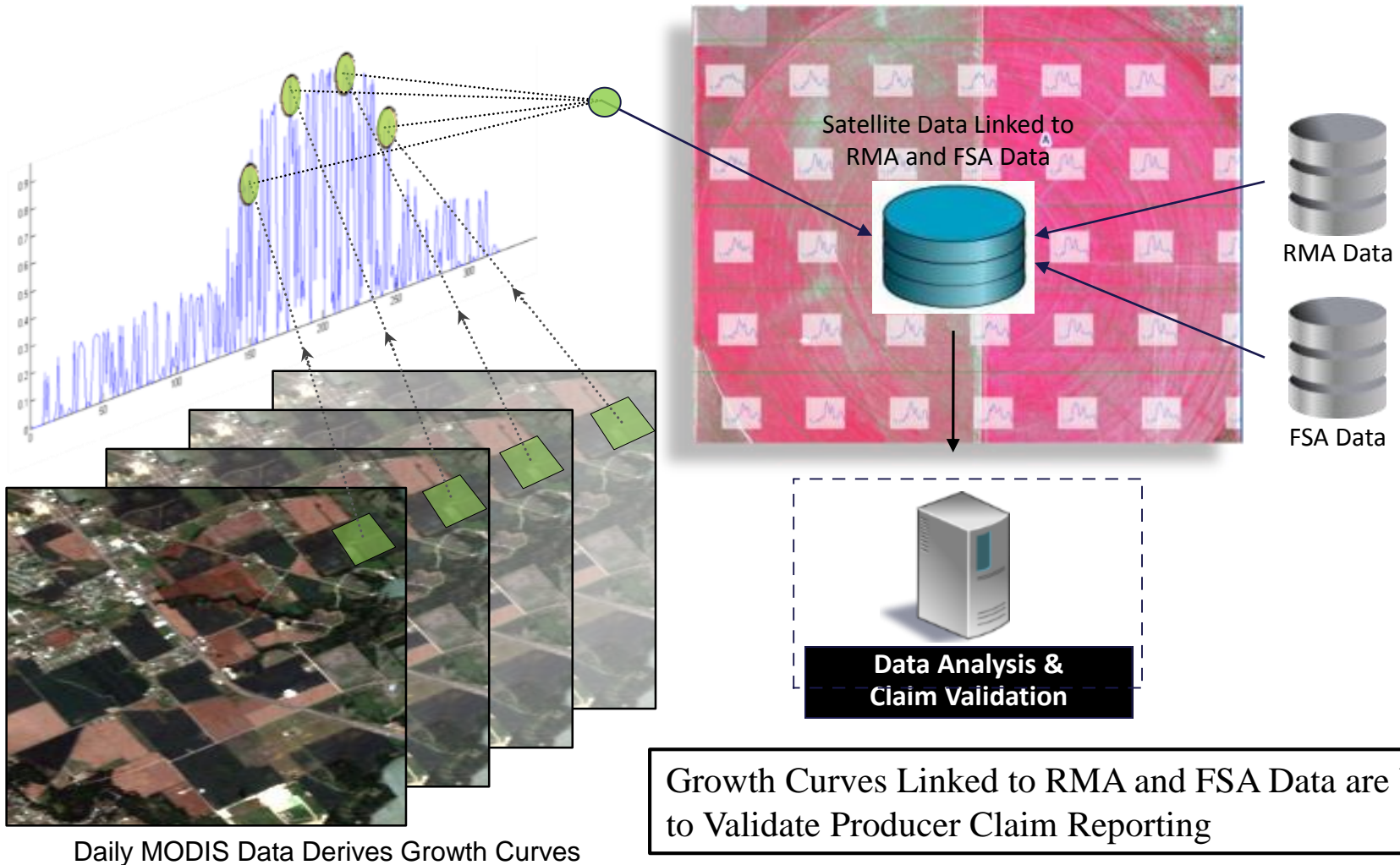
Typical MODIS Observed Phenologies over USA



Automated Crop Insurance Claims



Risk Management Agency

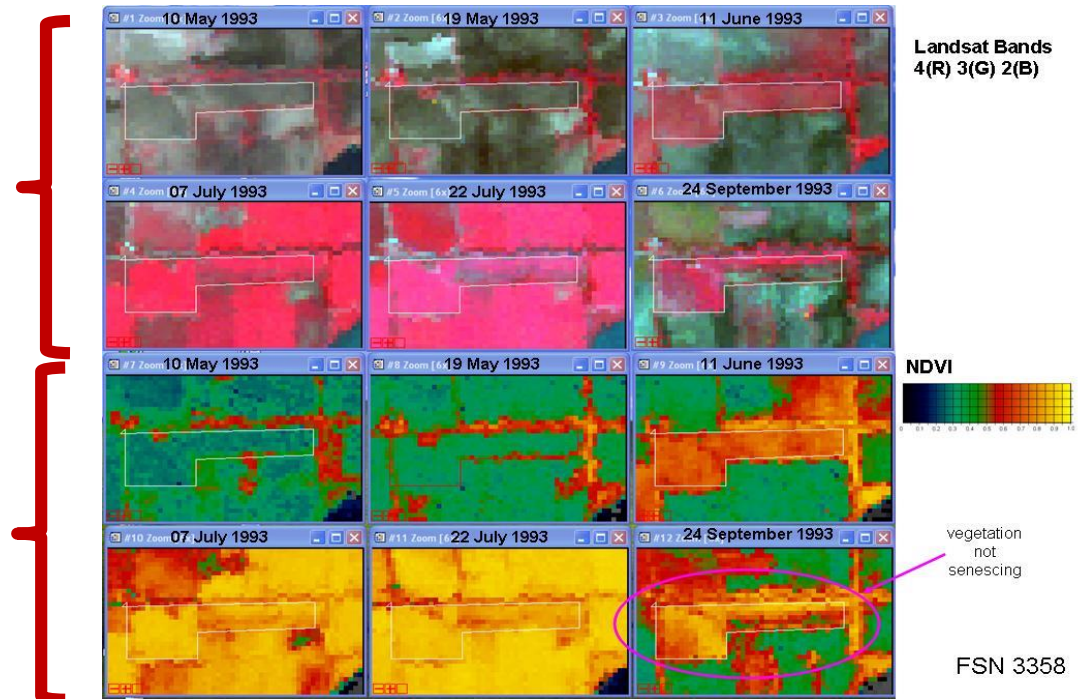


Compliance and Program Integrity

- *'Forensic'* remote sensing
 - Reconstruction of crop histories using moderate resolution satellite data
 - Often multiple years are investigated.
- **Among the issues analyzed:**
 - Presence / absence of crop
 - Crop type verification
 - Planting date verification

Facilitating Automated Crop Insurance Adjustment

Empirical Means for Cross Validation of Crop Loss



RMA and NASS are downloading all CONUS Landsat

- Processing for
 - Crop Type
 - Indicators of area, yield, and production
 - Indicators of crop damage from wind, hail, freeze, flood, tornadoes...
 - Indicators of farming practice: weeds, tilling, fertilizer application, pests, planting, harvest and irrigation
- RMA creating multiple indices for National field level data mining.

USDA Agencies: Attempt to understand conditions on all fields all the time



NASS: Area, Yield and Production.



FSA: To be eligible for farm programs, producers report what is grown to FSA.



RMA: Producers sign up for crop insurance at field level. Crop Insurance Programs



NRCS: Conservation programs and Conservation Easements.



APHIS: Monitor and Control of plant and animal disease



USDA Farm, Insurance, and Conservation Program Building Blocks



Over **36 million**
Common Land Unit
(CLU) Polygons
representing over **5**
million Farms
+ Crop Reporting
All CLUs have been
owner certified.



National Agriculture
Imagery Program
(NAIP) Imagery every 2
years

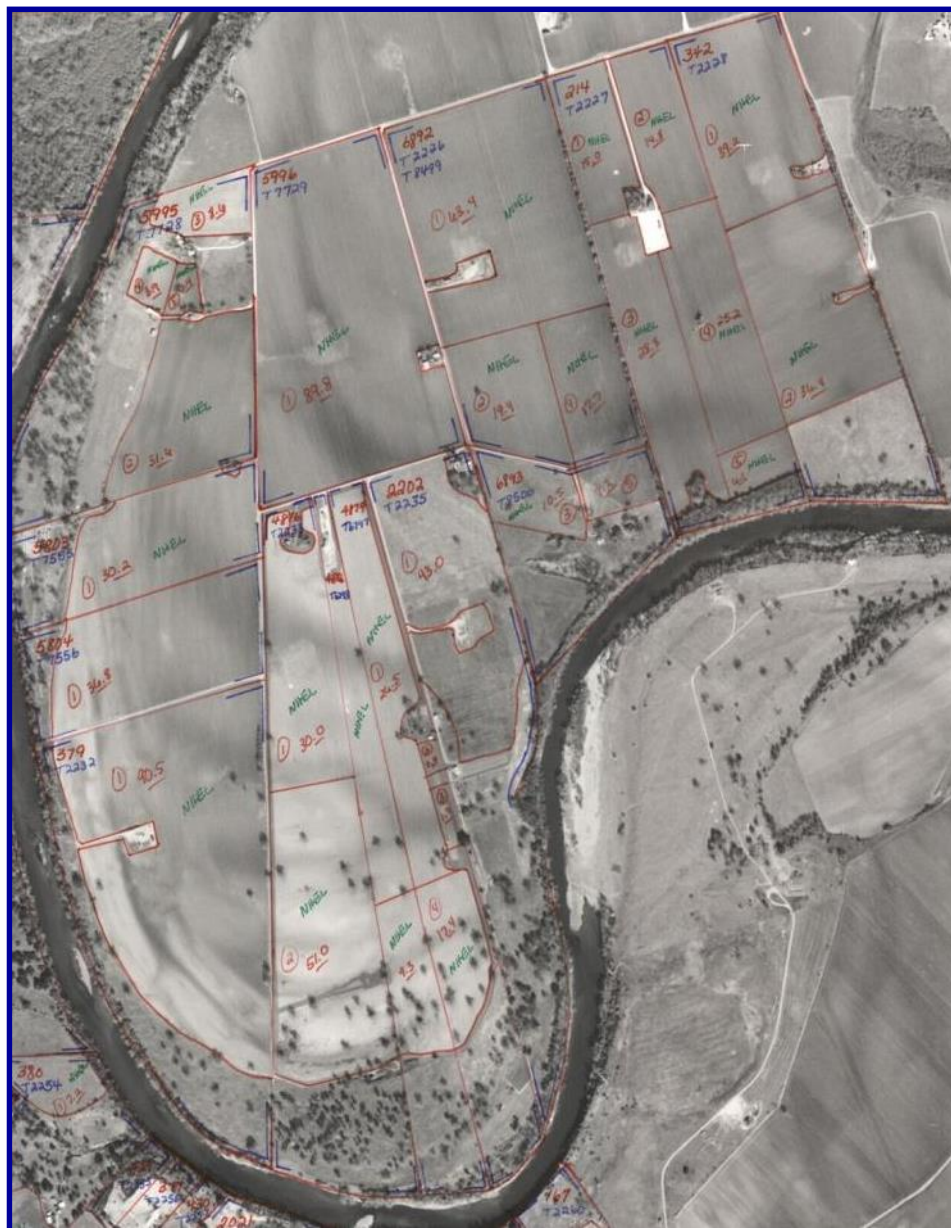


Confirmation of area
planted and crop
types.

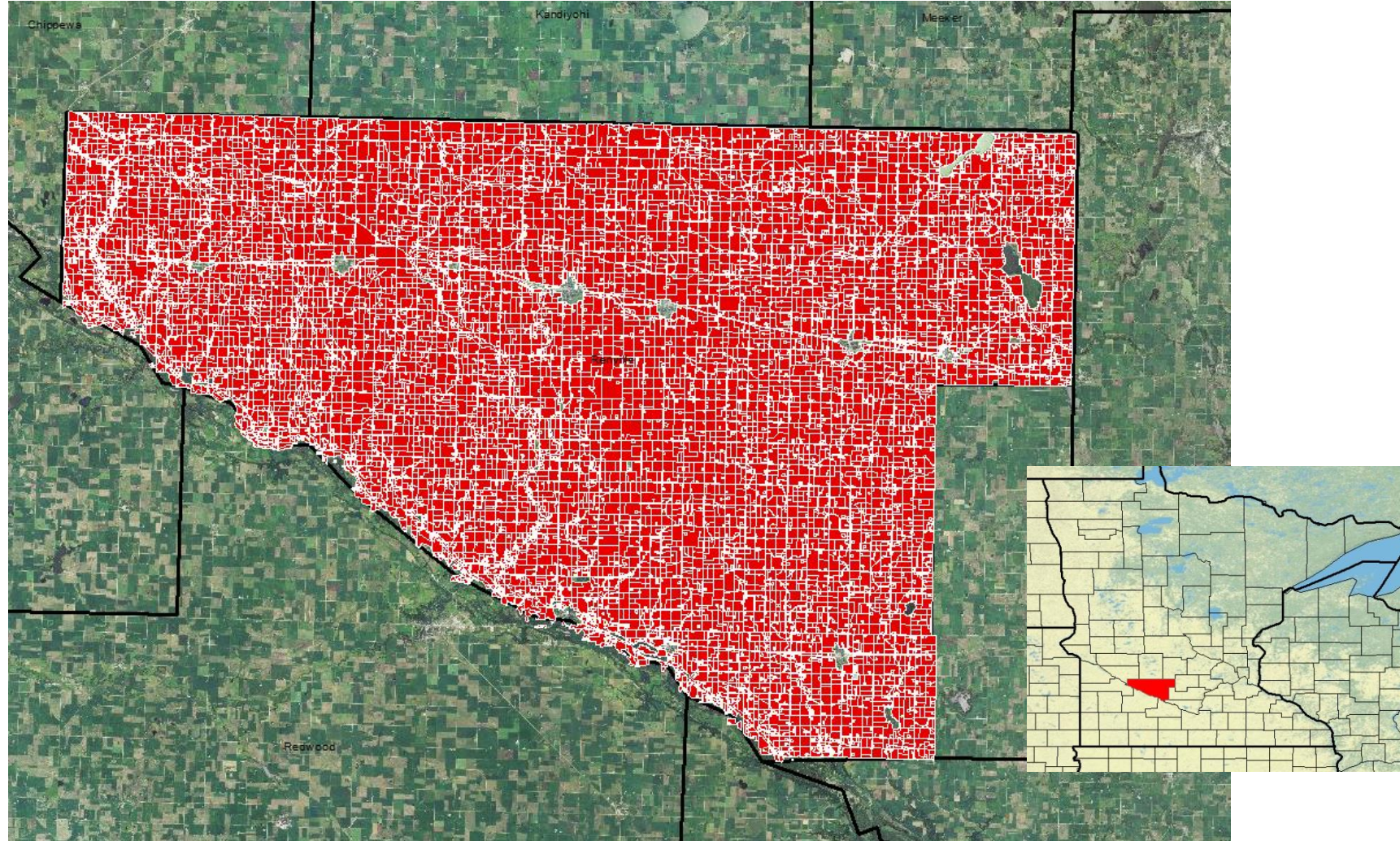
Farm, Conservation, Disaster, and Insurance Programs are Administered at the CLU level.



FSA maintains 36,000,000 Common Land Unit (CLU) shapefiles, to document planting, crop types, and yields



Common Land Unit: Renville, MN



Red area is the coverage of Common Land Units (a.k.a. field boundaries) for Renville, MN (13,137 polygons each associated with an owner, and crop reports.)

Satellites related to CLU in Renville County, MN

	Meters per Pixel	Minimum Width (Meters)	Minimum Acres to Observe a Pure Pixel	Total with CLUs with a Pure Pixel	Percent CLUs imaged
Sentinel 2	20	60	0.89	12,539	95%
Landsat	30	90	2.00	11,733	89%
MODIS	250	750	139.00	1,266	10%
VIIRS	375	1125	312.75	33	0%
AVHRR	1100	3300	2691.03	-	0%
Total CLUs in Renville				13,137	

- When the MODIS sensors are deorbited, no daily field level monitoring by VIIRS.
- Sentinal-2 will allow for the monitoring 6% additional fields compared to Landsat.

Walla Walla, Washington



D=460

- Only one Center Pivot can be monitored with MODIS
- No fields large enough to monitor with VIIRS
- All can be monitored with Landsat or Sentinel-2

D=118

D=266m

D=740

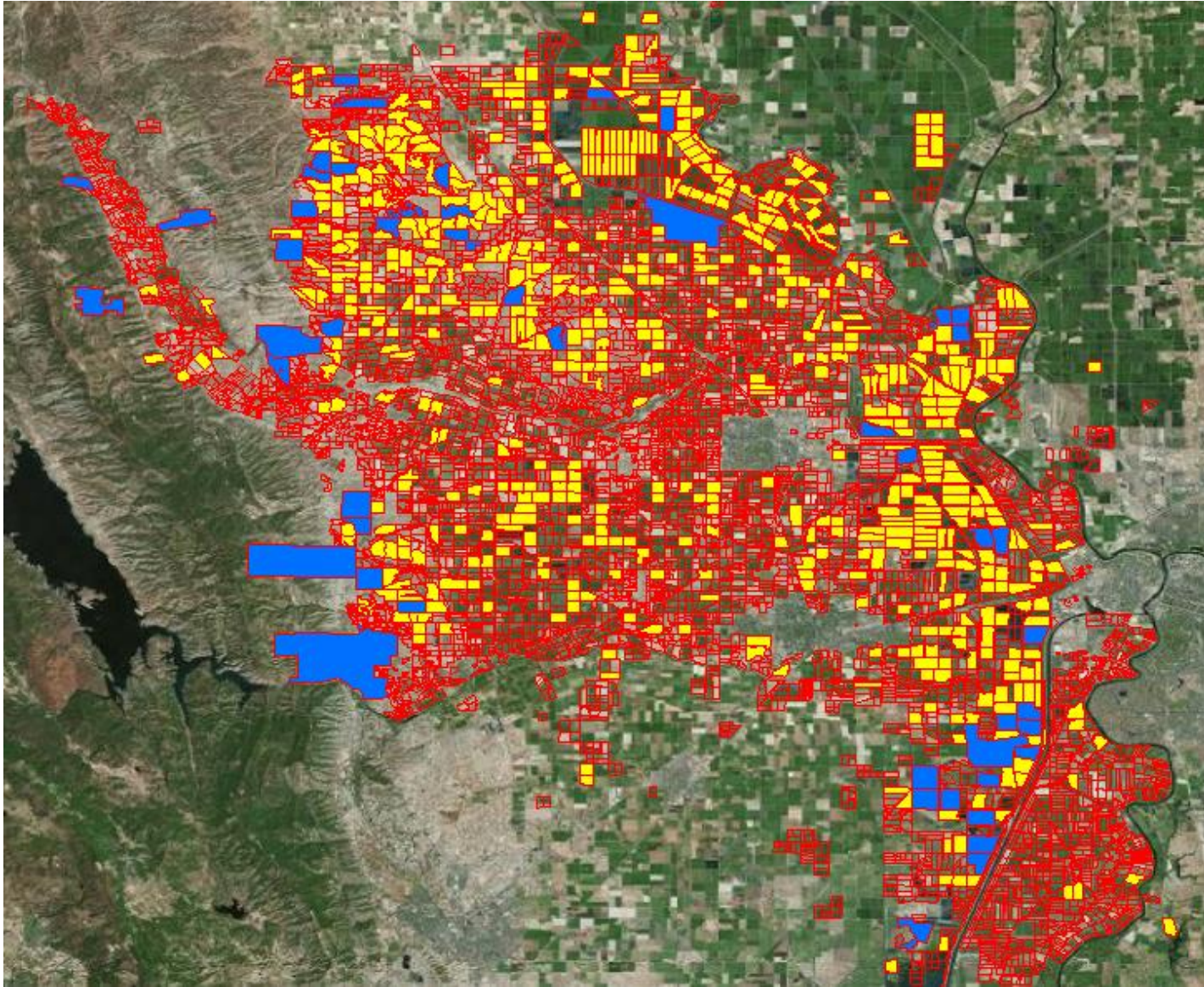
D=790
Monitor
with MODIS

D=572

Yolo County, CA

Blue areas candidate CLUs for monitoring with VIIRS

Yellow areas: Candidate CLUs for monitoring with MODIS



International Production Assessment



United States Department of Agriculture(USDA)
Foreign Agricultural Service (FAS)

IMAGERY (OPERATIONAL: RELIES ON MULTIPLE SOURCES)

Imagery is obtained from Multiple Sensors, Space Agencies, and Private Sector.

NASA

NOAA

USGS

ESA

ISRO

JAXA

CNES

AIRBUS Defense & Space

DMC: UK Space, Elecnor

DigitalGlobe via NGA



Ideally, all imagery processed before analysis:

★ GIS Ready (Ready to be incorporated into analysis)

- Ortho Rectified
- Calibrated / Cross Calibrated

★ Low Latency

- 4-6 hours Ideal
- 1 – 3 days acceptable with More than 5 days, **Not Acceptable**

Crop Explorer

Public Interface to time series weather and vegetation condition data sets over major crop regions, Updates every 1 to 10-days

Maps and time-series charts for:

• Weather Data (AWFA, WMO, CMORPH, MPA, and NEXRAD)

- Dekadal (10-day) precipitation & temperatures compared to climate normals

• Soil Moisture & Crop Models

- Modified Palmer two-layer soil moisture
- Behind firewall: Crop calendars for wheat, corn, & sorghum and corn hazard/alarm model.

• Vegetation Indices (polar-orbiting satellites)

- GAC (8-km) (behind firewall)
- SPOT-VEG (1-km)
- MODIS (250-m)

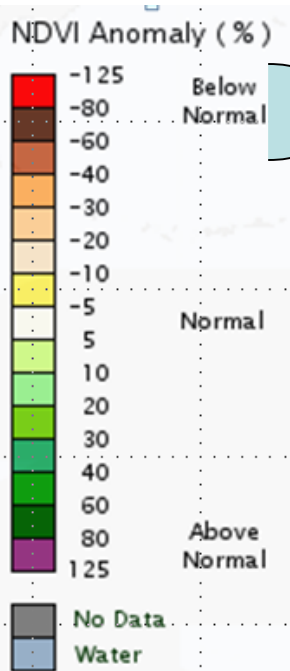
• Daily MODIS

- Aqua and Terra (250-m)

• Lake/Reservoir Heights

- TOPOX/Poseidon, Jason-1, Jason-2
- GFO
- ERS, ENVISAT

Global NDVI Anomaly



- FAS funds NASA for processing and cross calibration
- Focus on areas better or worse than normal
- <http://glam1.gsfc.nasa.gov/>

Global Agricultural Monitoring



System Status

v2.1.0

● Terra production is offline

Select Layers

Satellite

Aqua

Layer

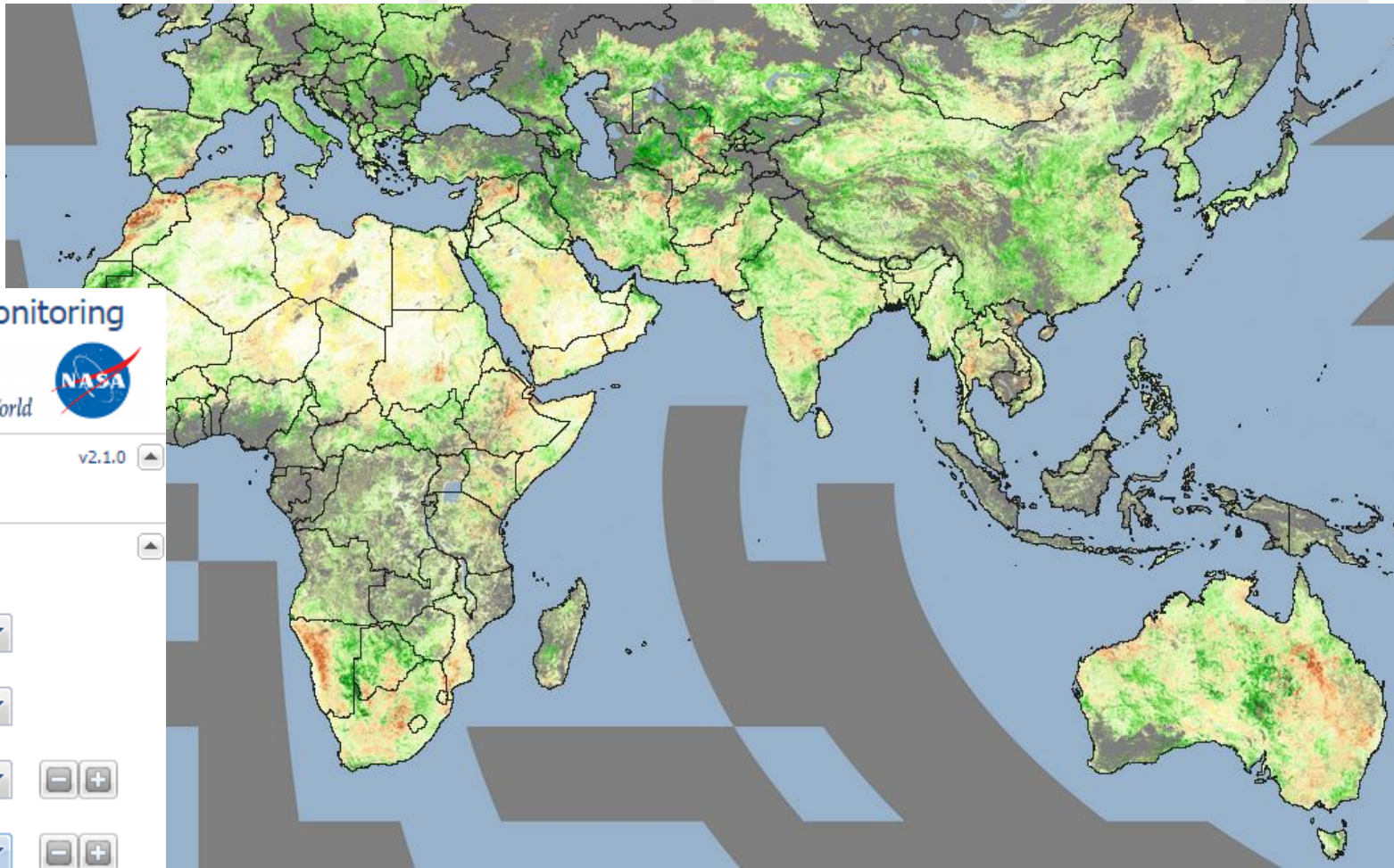
NDVI Anomaly (%)

Year

2016

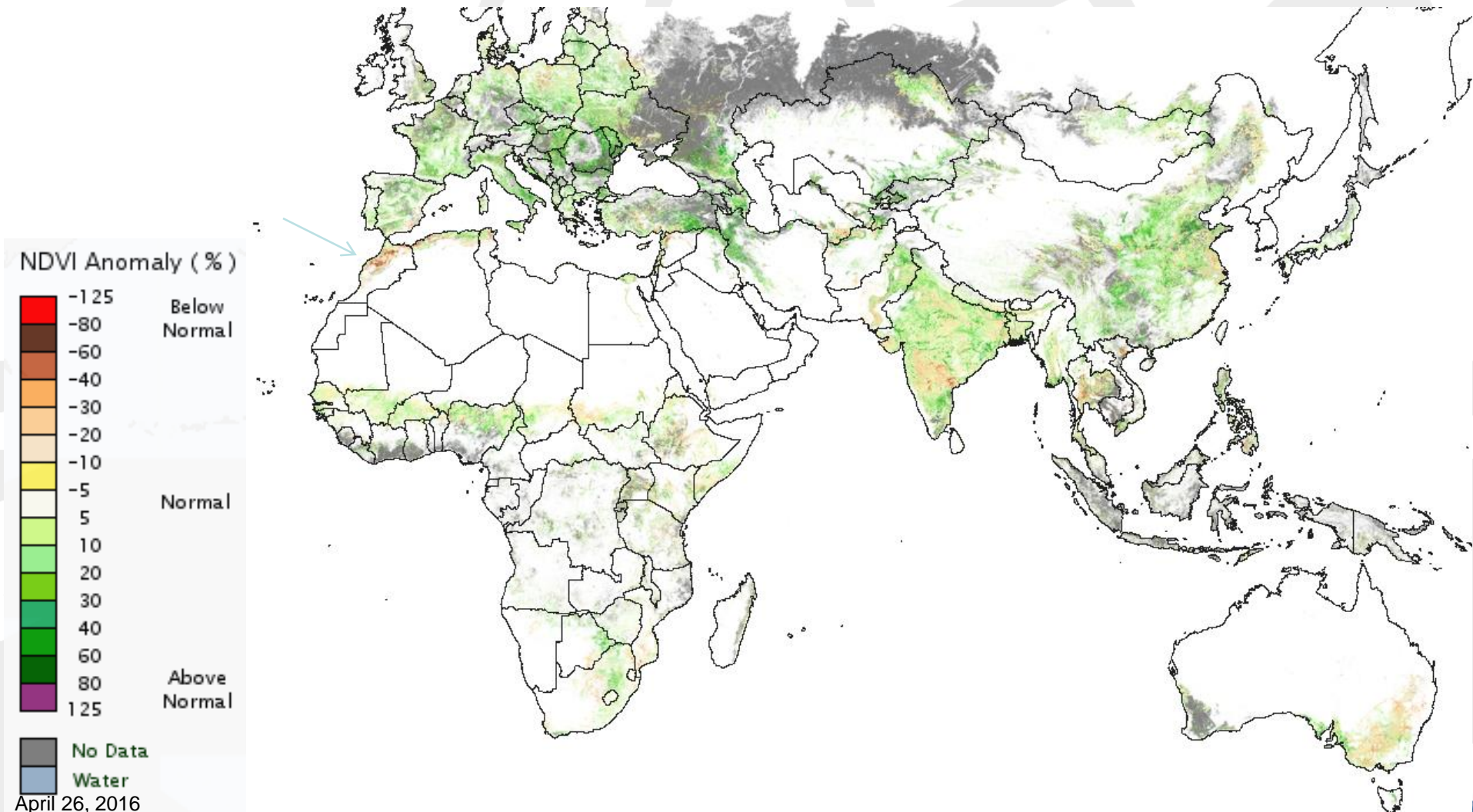
Start DOY : MM/DD Range

81 : 03/21 - 03/28



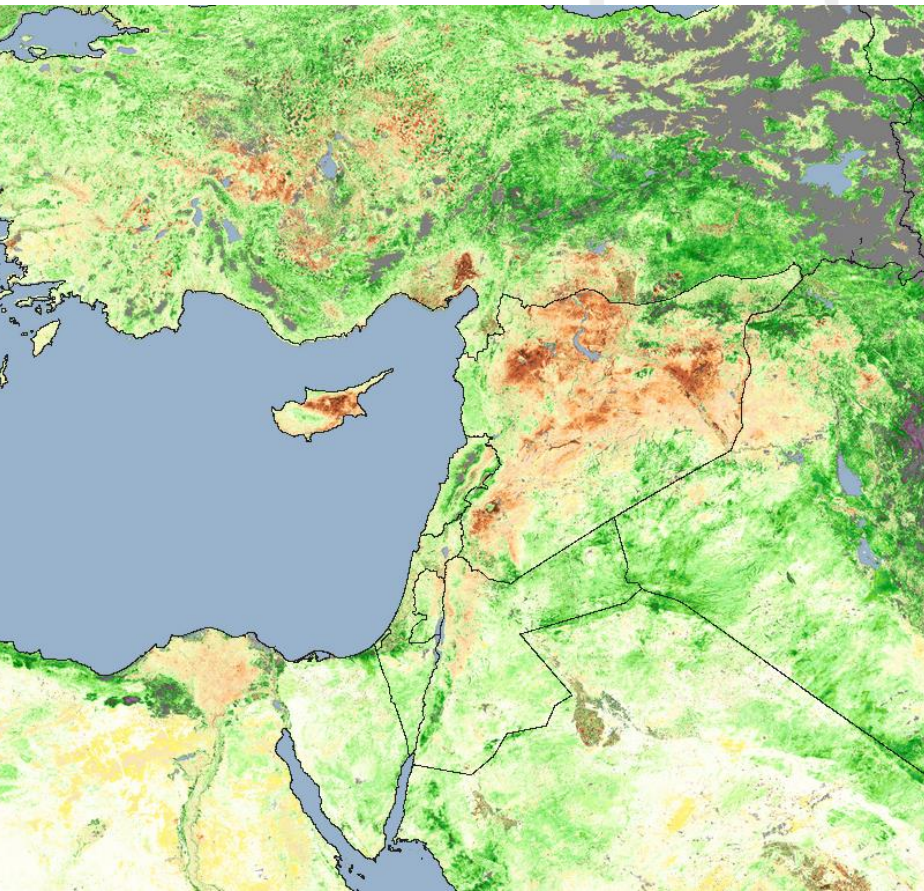
Crop Masked Global NDVI Anomaly

Focus on cropped areas better or worse than normal

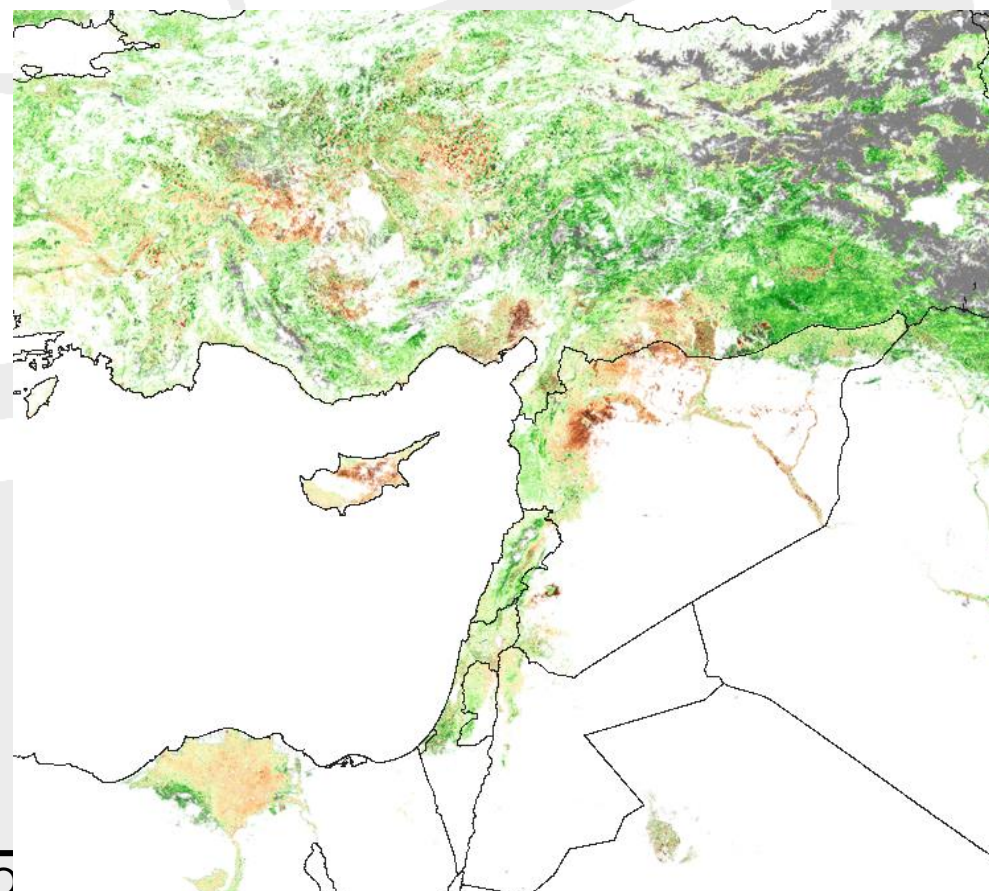


Focus on Crops not all Vegetation

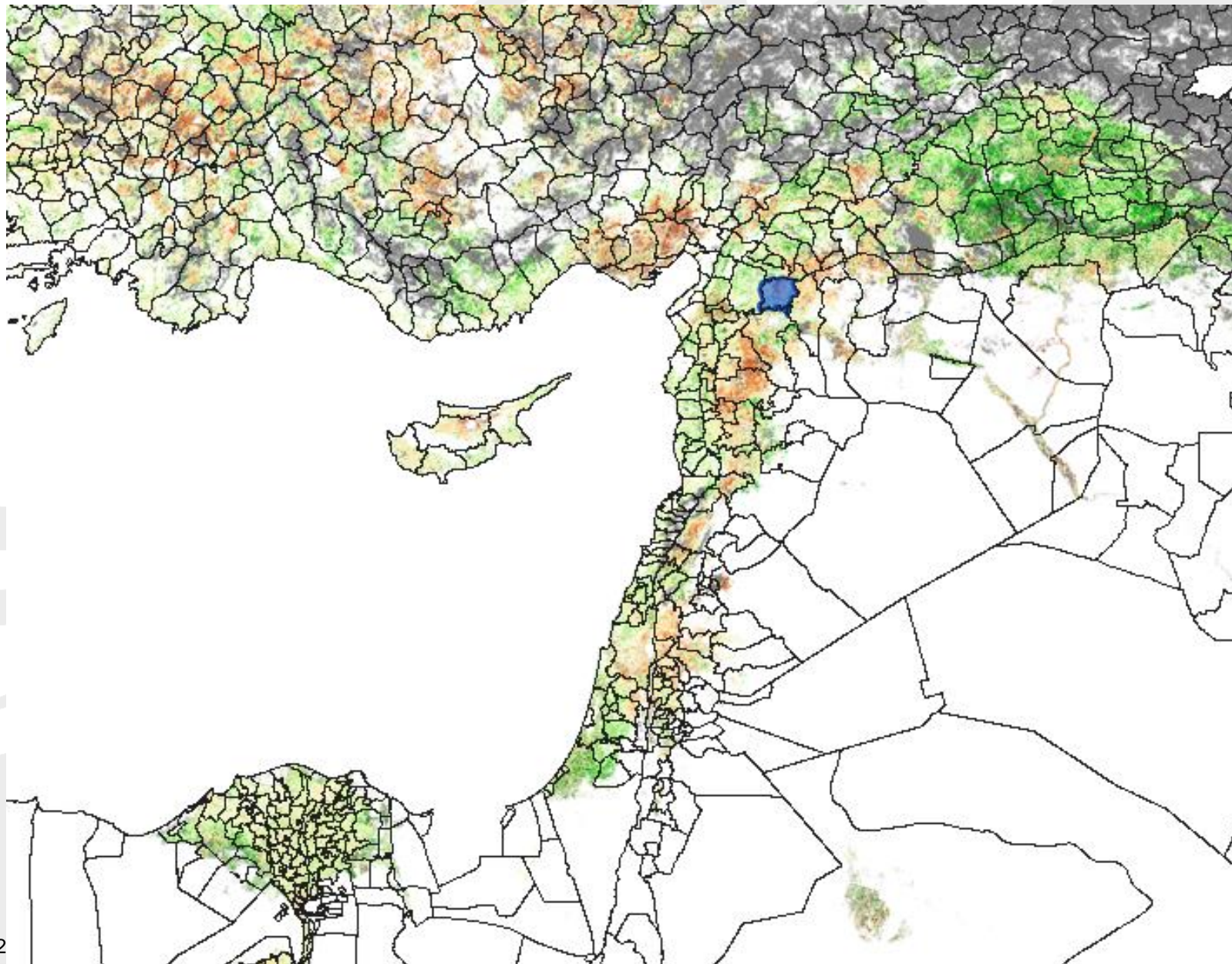
No Crop Mask



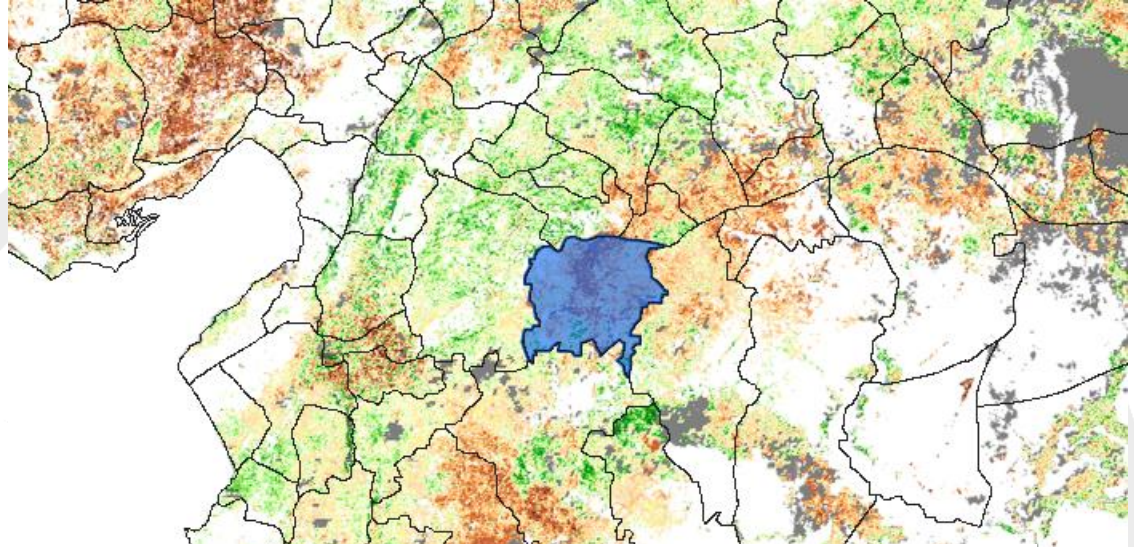
Masked with Globecover 2009



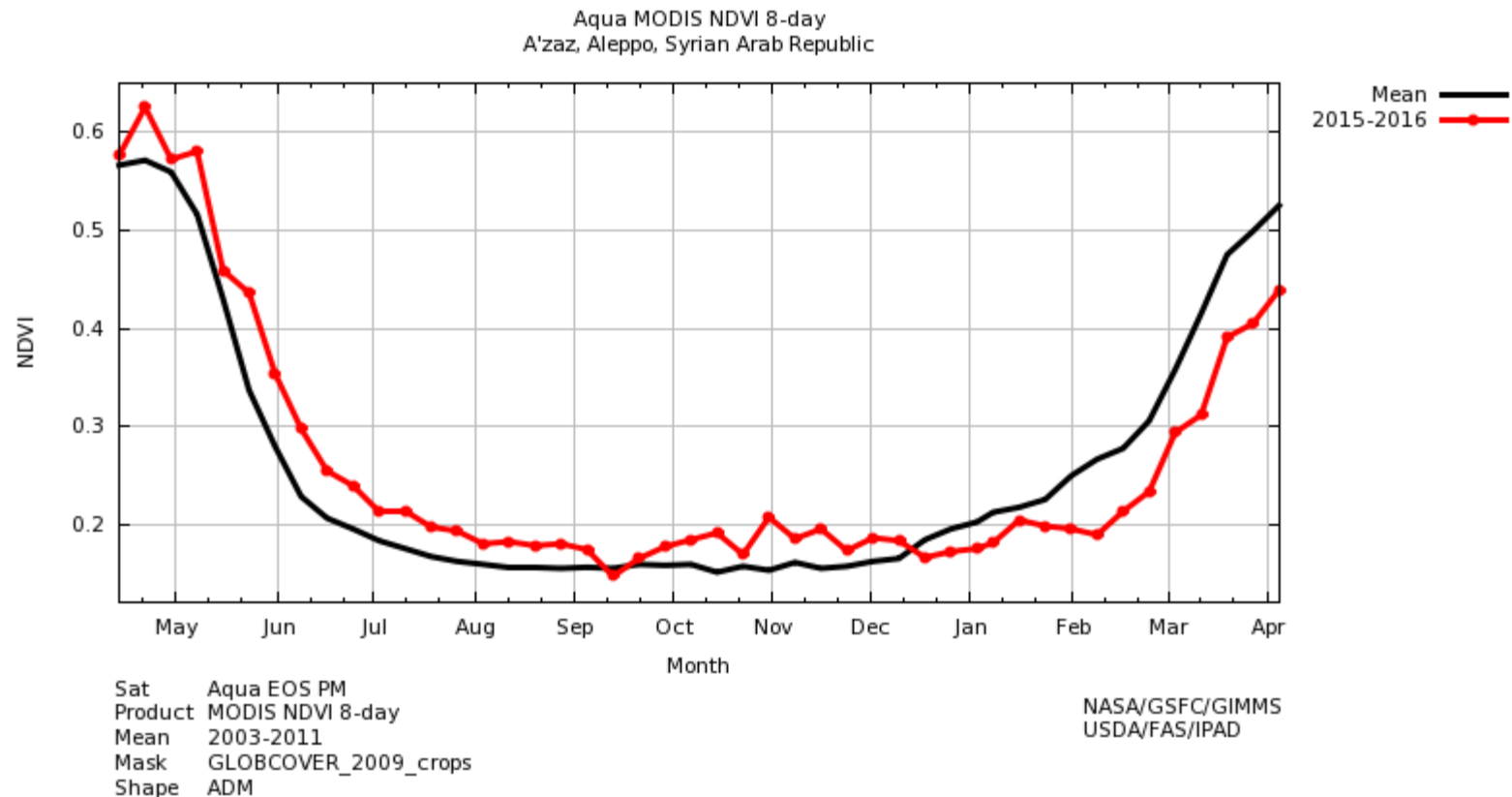
Focus on Aleppo, Syria



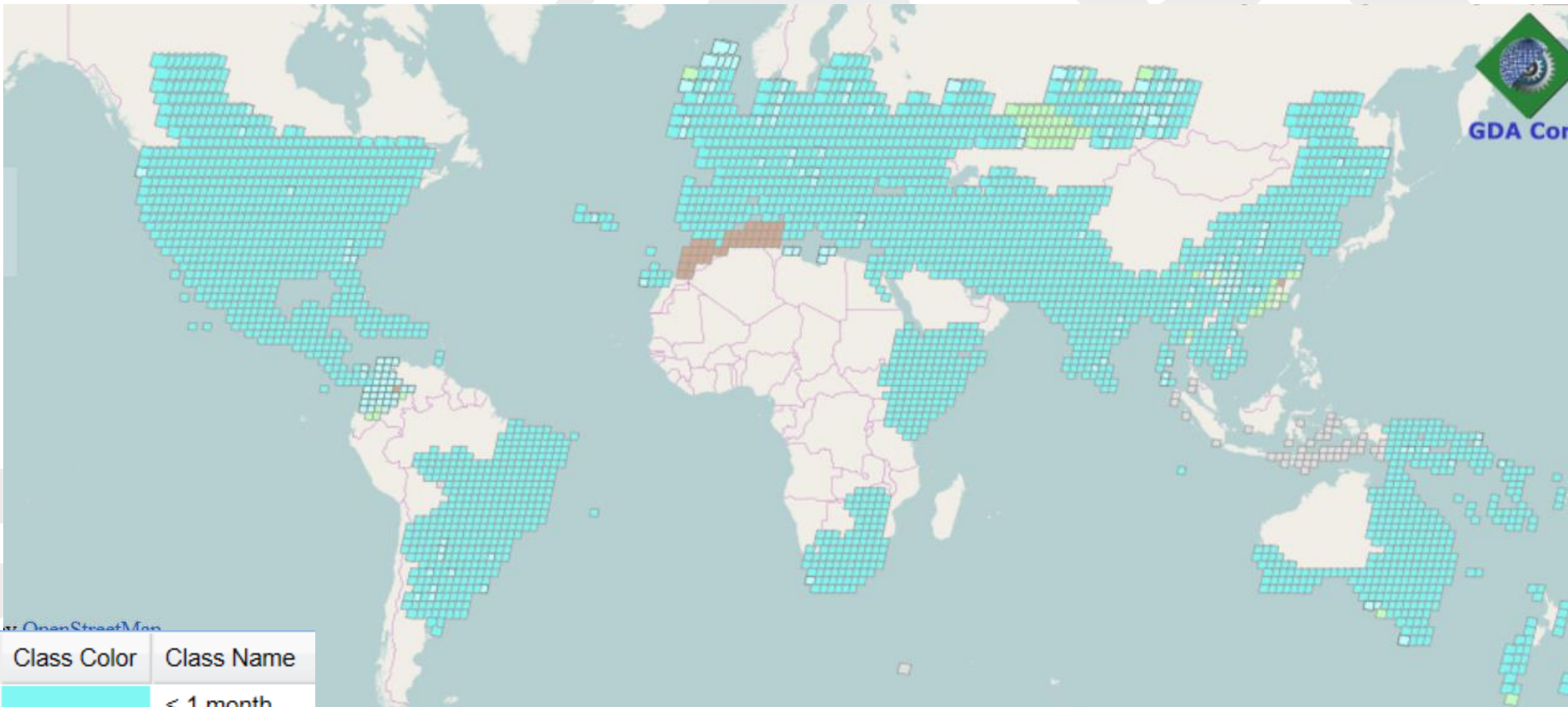
Tools to quantify crops this year related to normal using MODIS time series



Plot 1. IPAD Time Series



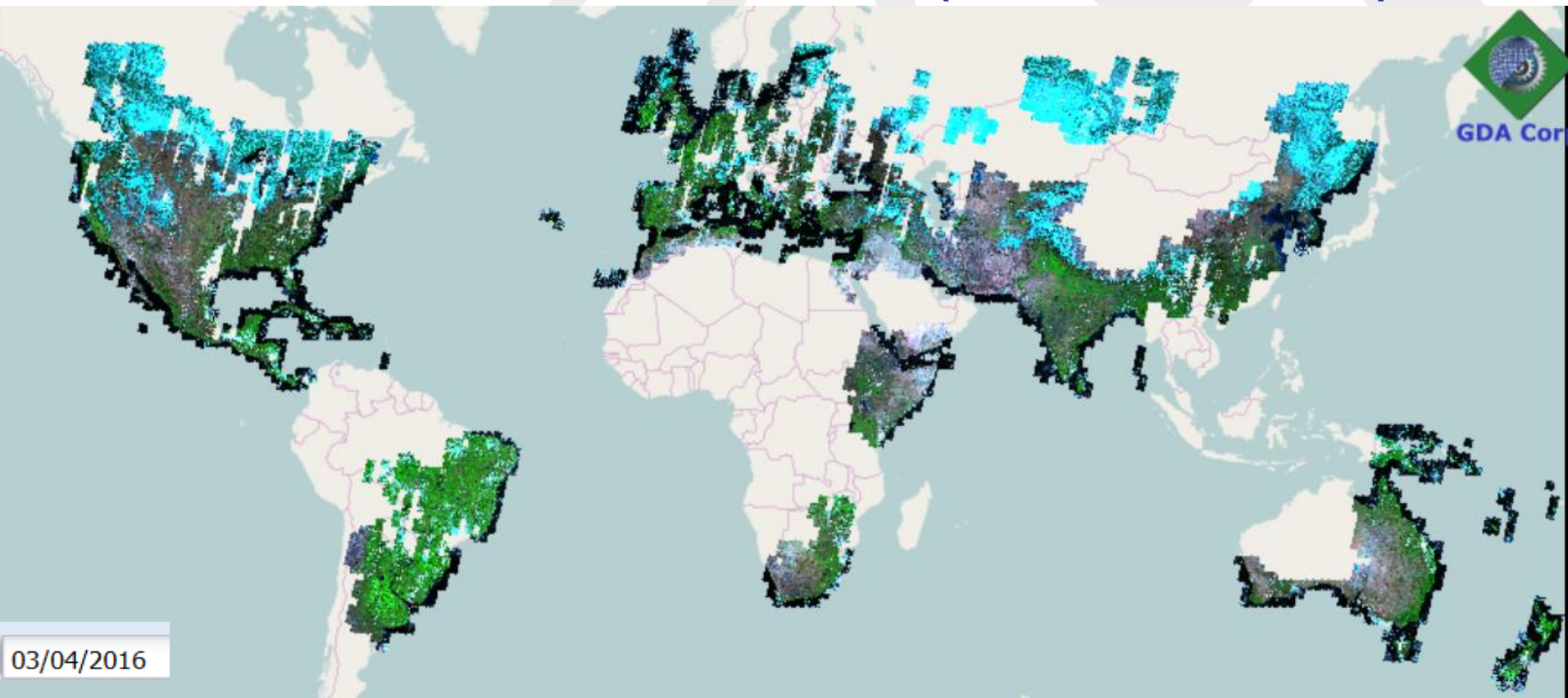
Global Landsat Ready For Analysis of Crop Conditions



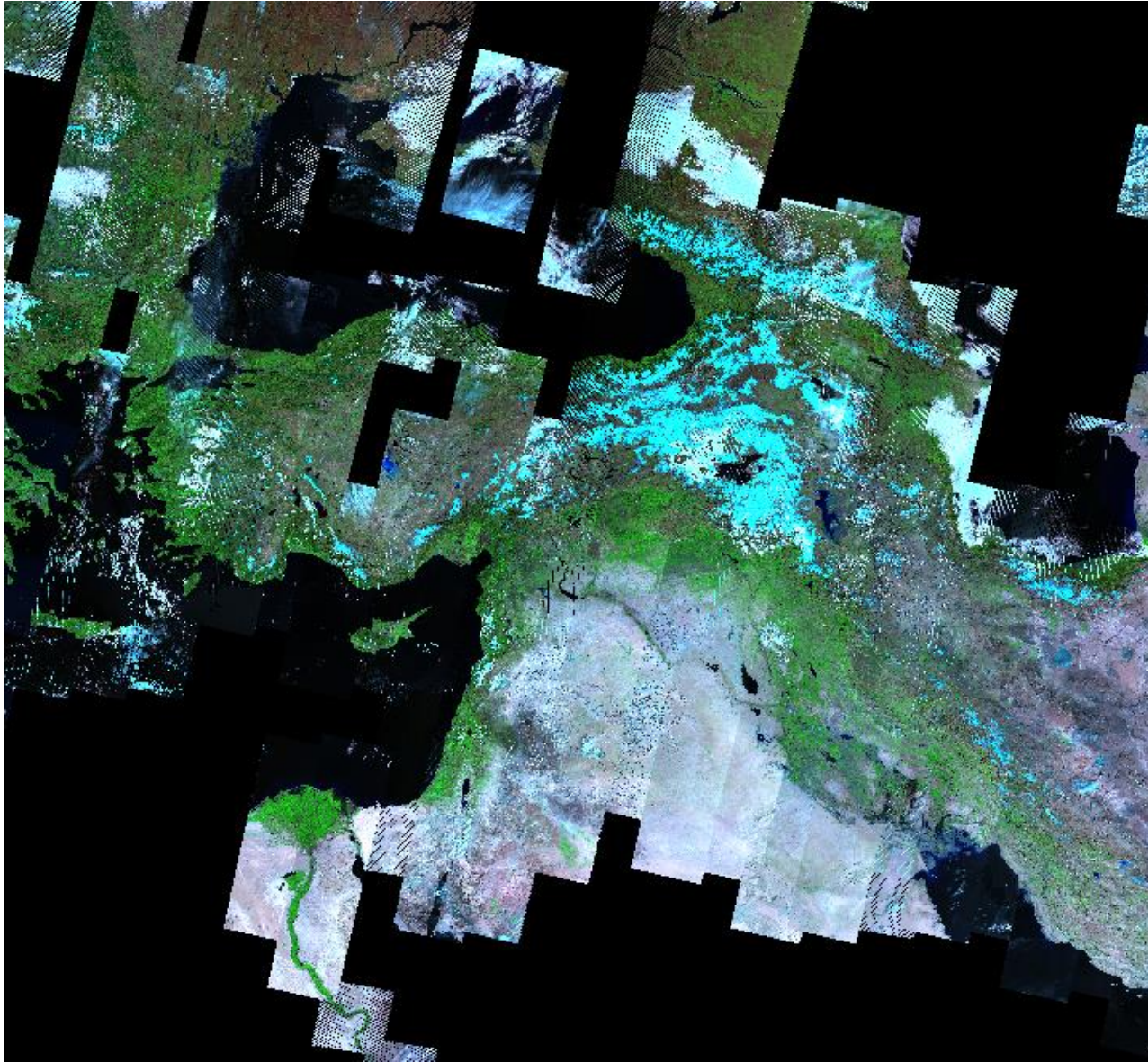
Class Color	Class Name
Cyan	< 1 month
Light Blue	1 - 2 months
Light Green	2 - 3 months
Yellow	3 - 4 months
Brown	4 - 5 months
Grey	> 5 months

Landsat imagery to the surface reflectance, prepares it for mosaicking and on-line, real time analysis, masking, times series analysis, mapping, and download.

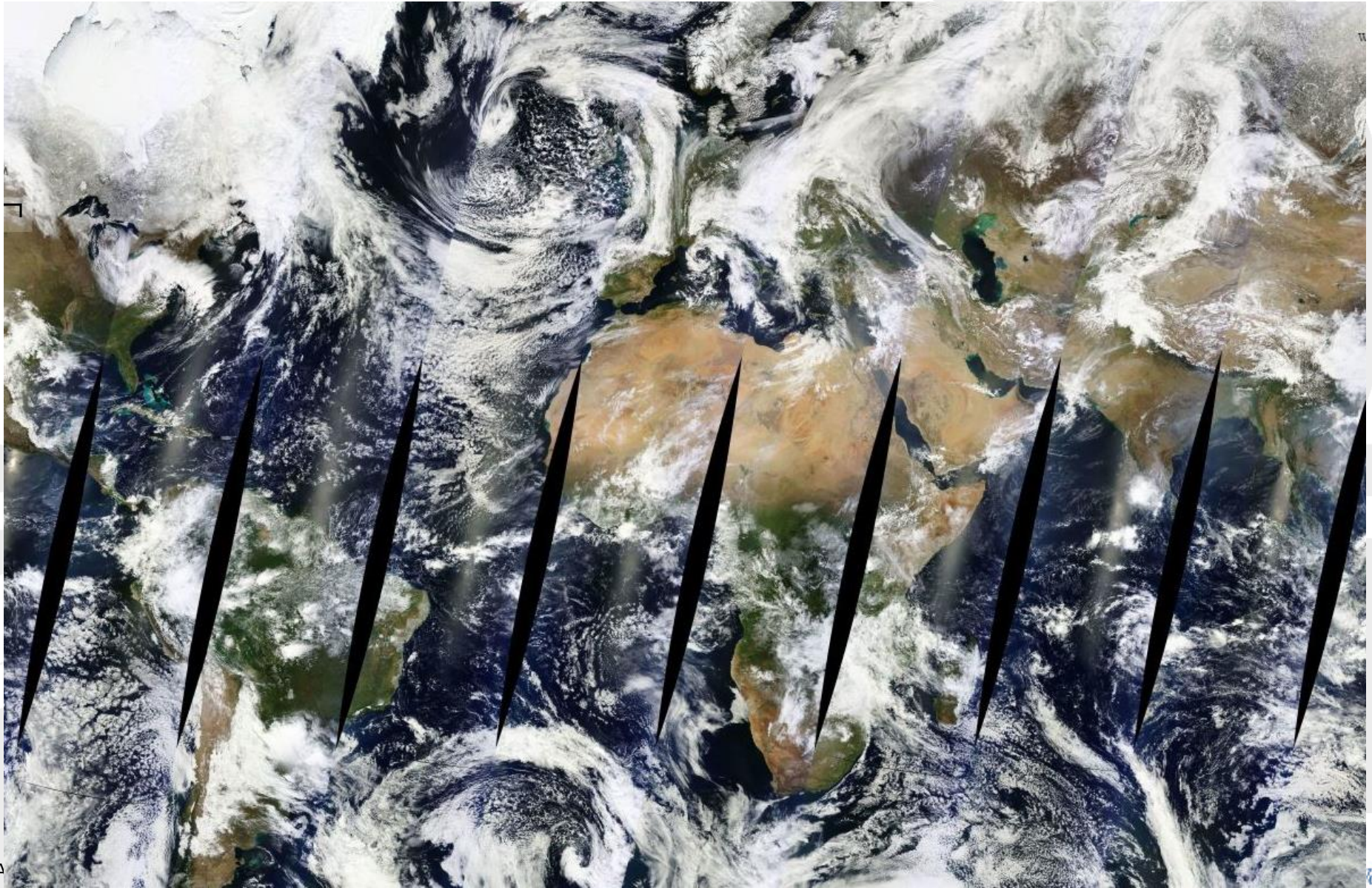
Every 16 days, create a surface reflectance mosaic (LS 7 and 8)

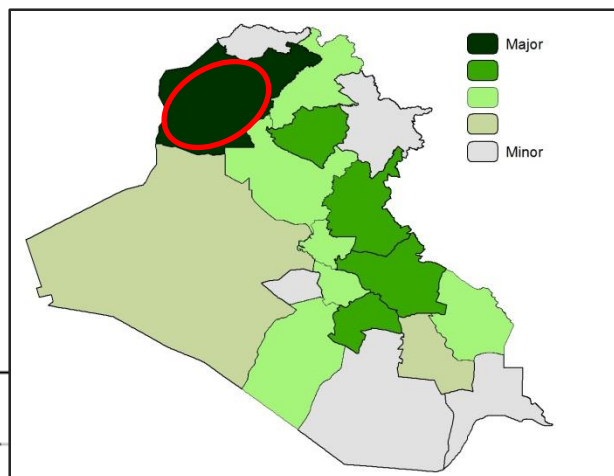


Analyst can use mosaics rather than
many WRS scenes

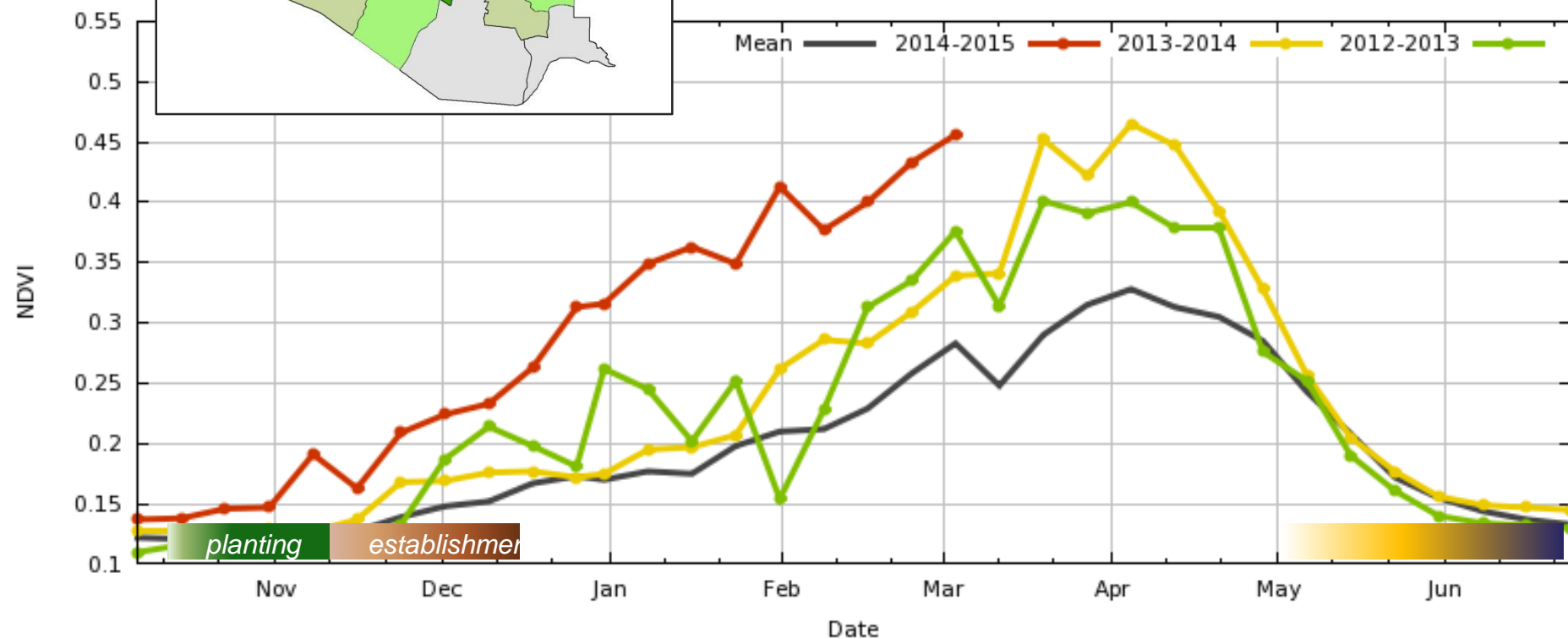


Daily Surface Reflectance for MODIS Aqua and Terra





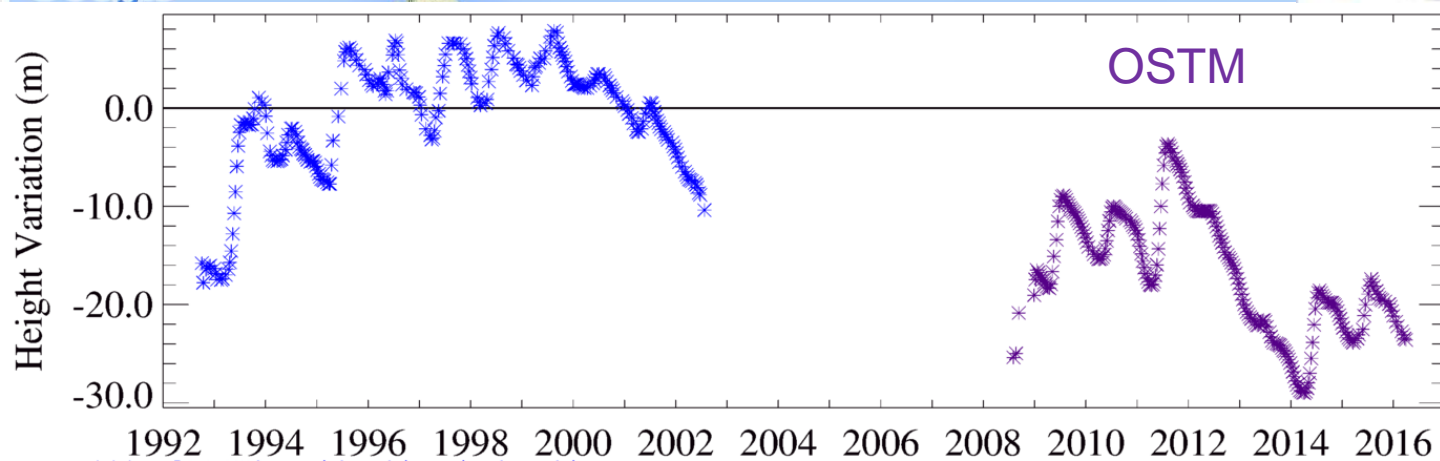
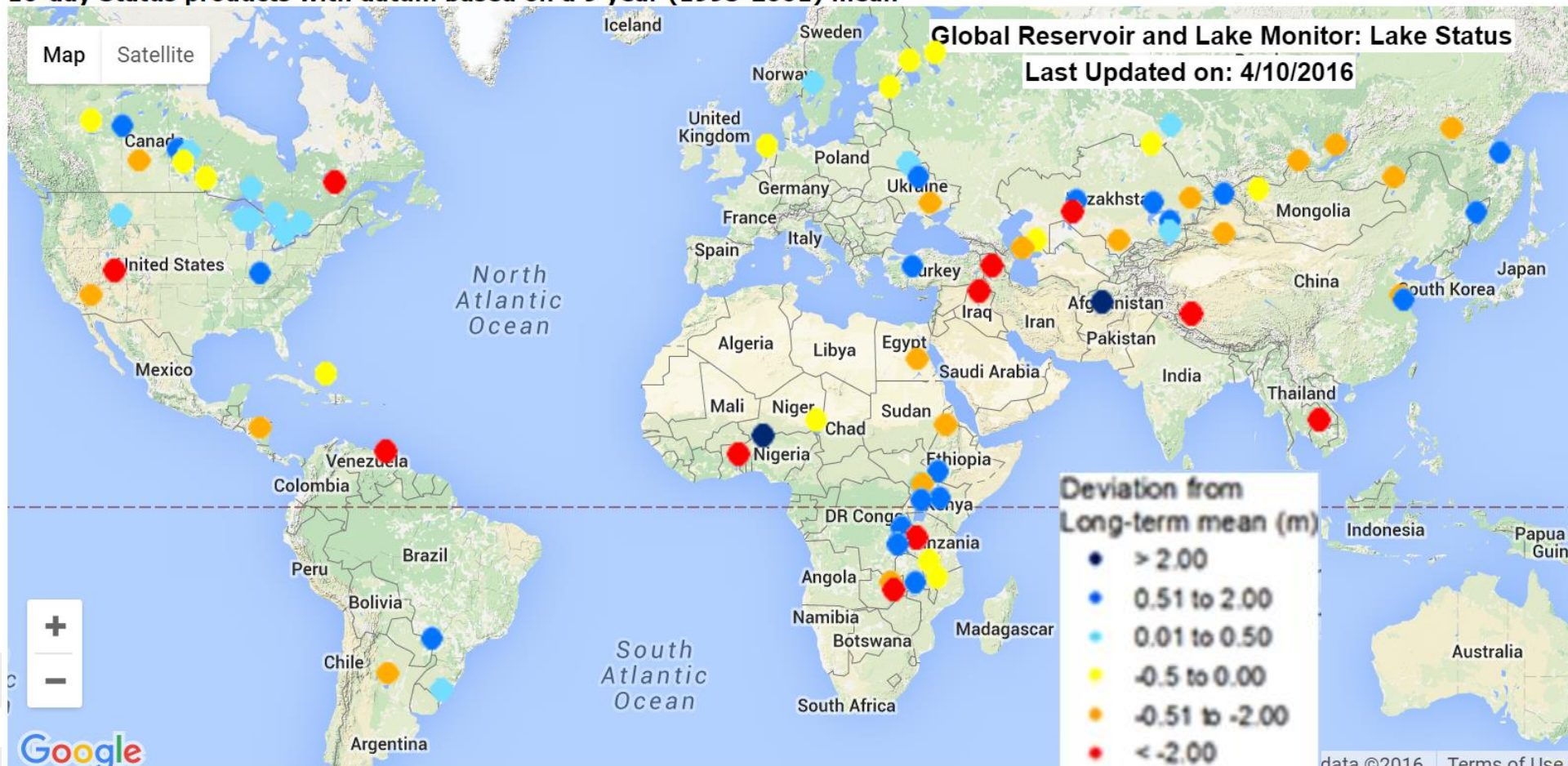
Aqua MODIS NDVI 8-day
Ninawa, Iraq



Sat Aqua EOS PM
Product MODIS NDVI 8-day
Mean 2003-2011
Mask GCLC_1990_2000_crops
Shape ADM
Unit Ninawa, Iraq

NASA/GSFC/GIMMS
USDA/FAS/IPAD

10-day Status products with datum based on a 9 year (1993-2001) mean



Altimetry

Lake Powell
25 m below
average

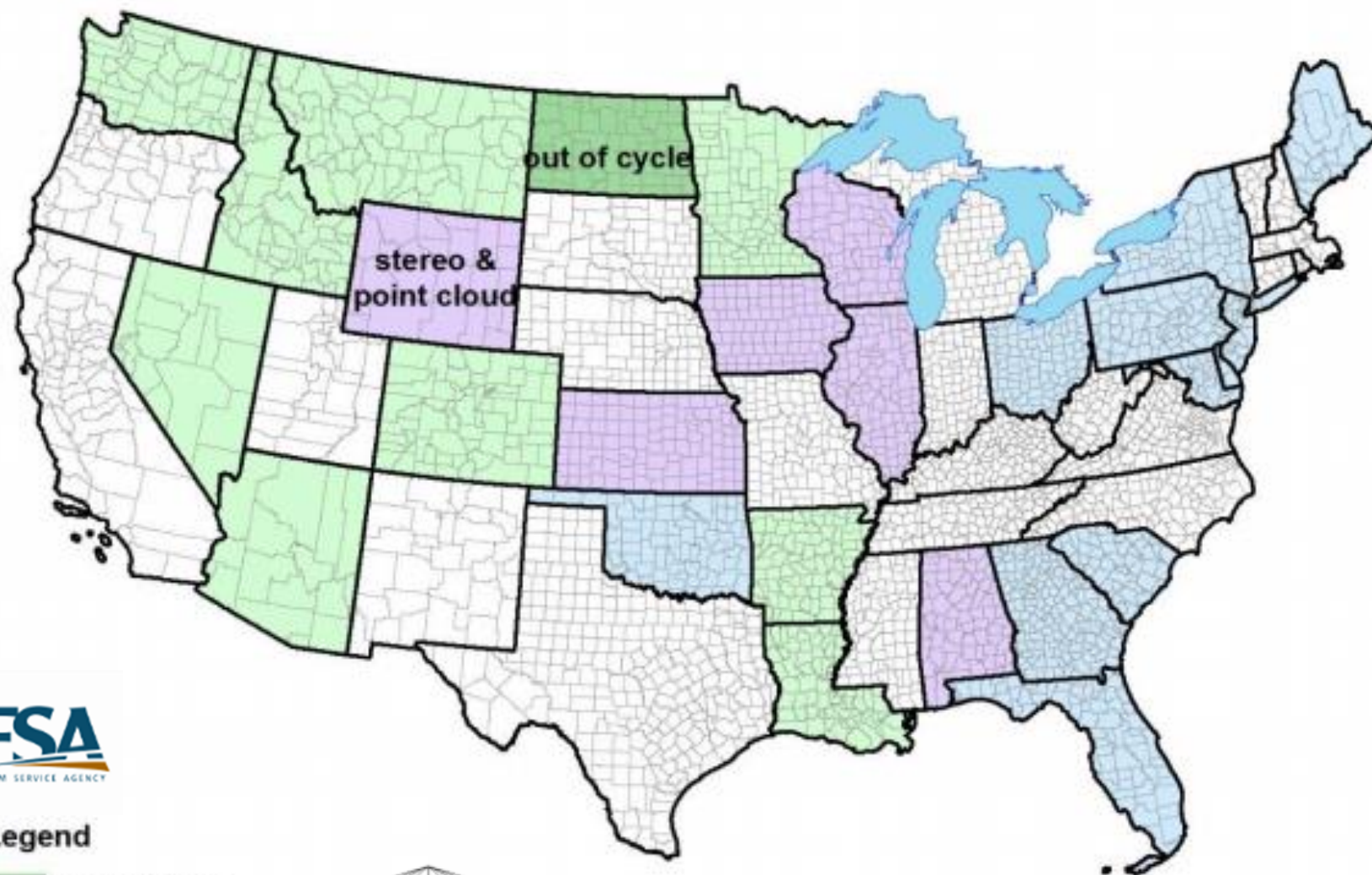
Linking U.S. Agriculture to the World

National Agriculture Imagery Program

- Leaf-on 1 meter or ½ meter orthoimagery program
- 4 bands
- NAIP is a key geospatial investment
 - FSA farm based information and Compliance
- Farm Service Agency (FSA) (\$10,140,00)
 - Main Cost Share Partners: (\$6,040,000)
 - Natural Resources Conservation Service (NRCS)
 - Forest Service (FS)
 - US Geological Survey (USGS)



2015 National Agriculture Imagery Program



Legend

- North West
- Quantum
- Surdex

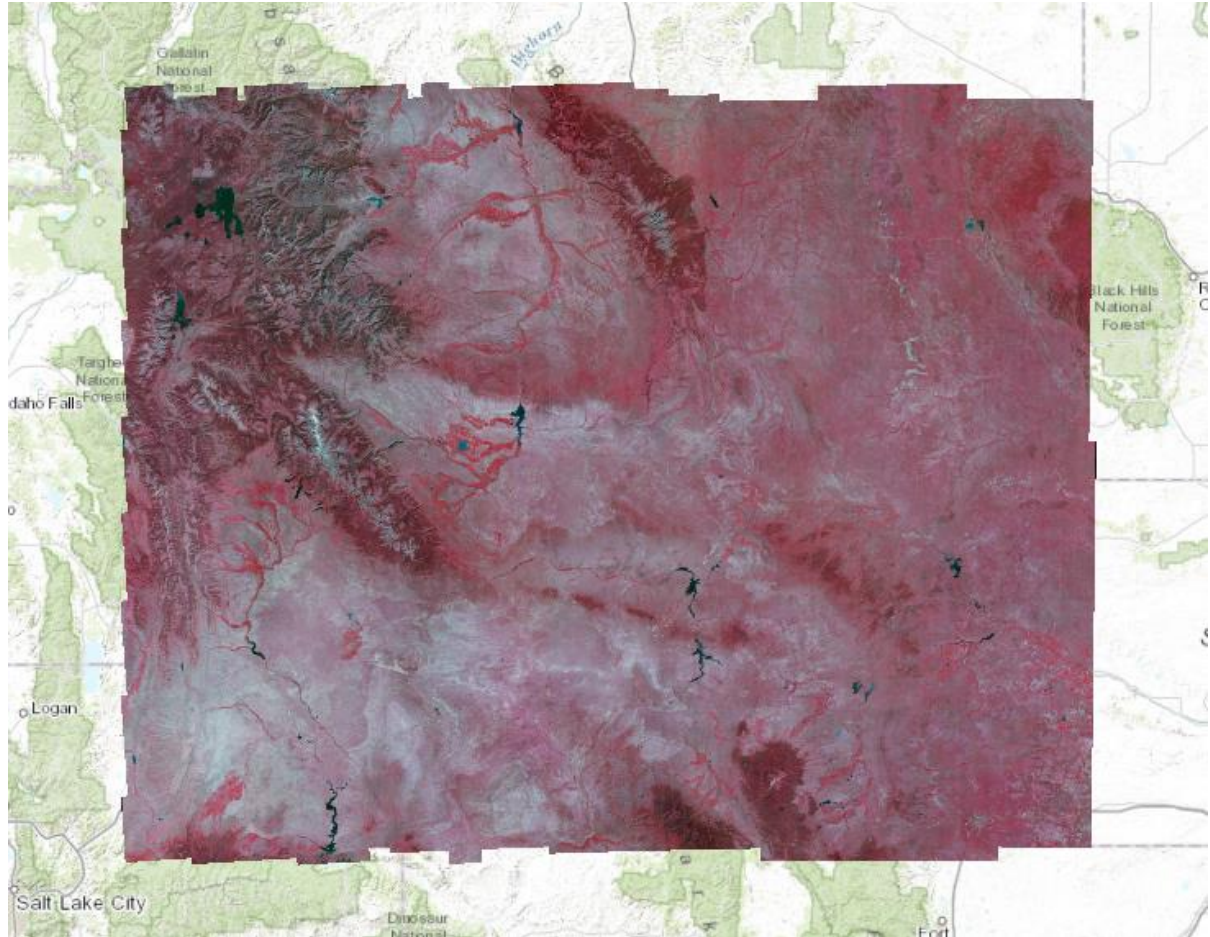


NORTH WEST GROUP



States: 27
DOQQs: 125,305

2015 NAIP for Wyoming



Cost Share for Buy-up deliverables:

- Bureau of Land Management
- US Forest Service
- local governments

Awarded to Surdex Corporation



Approach

- Acquisition with Leica ADS100 pushbroom sensor
 - 20,000 pixels wide at nadir
 - RGBN for nadir, forward, aft arrays
 - Swath at 0.5m is ~6.2 miles or ~ 10km
 - Swath of IKONOS Satellite was 11.3km at Nadir
- Acquisition design
 - Flown in Cessna 441 (Conquest) pressurized, twin-turbine aircraft
 - ~20,500 feet above ground level (AGL)
 - ~29,000 statute flight line miles (FLM) – ~2X that of 1-meter coverage
 - $\geq 27\%$ sidelap
 - Full stereoscopic coverage
 - Two UTM zones (12 & 13)
 - Each flight was line limited to ~80 nautical miles (IMU drift)



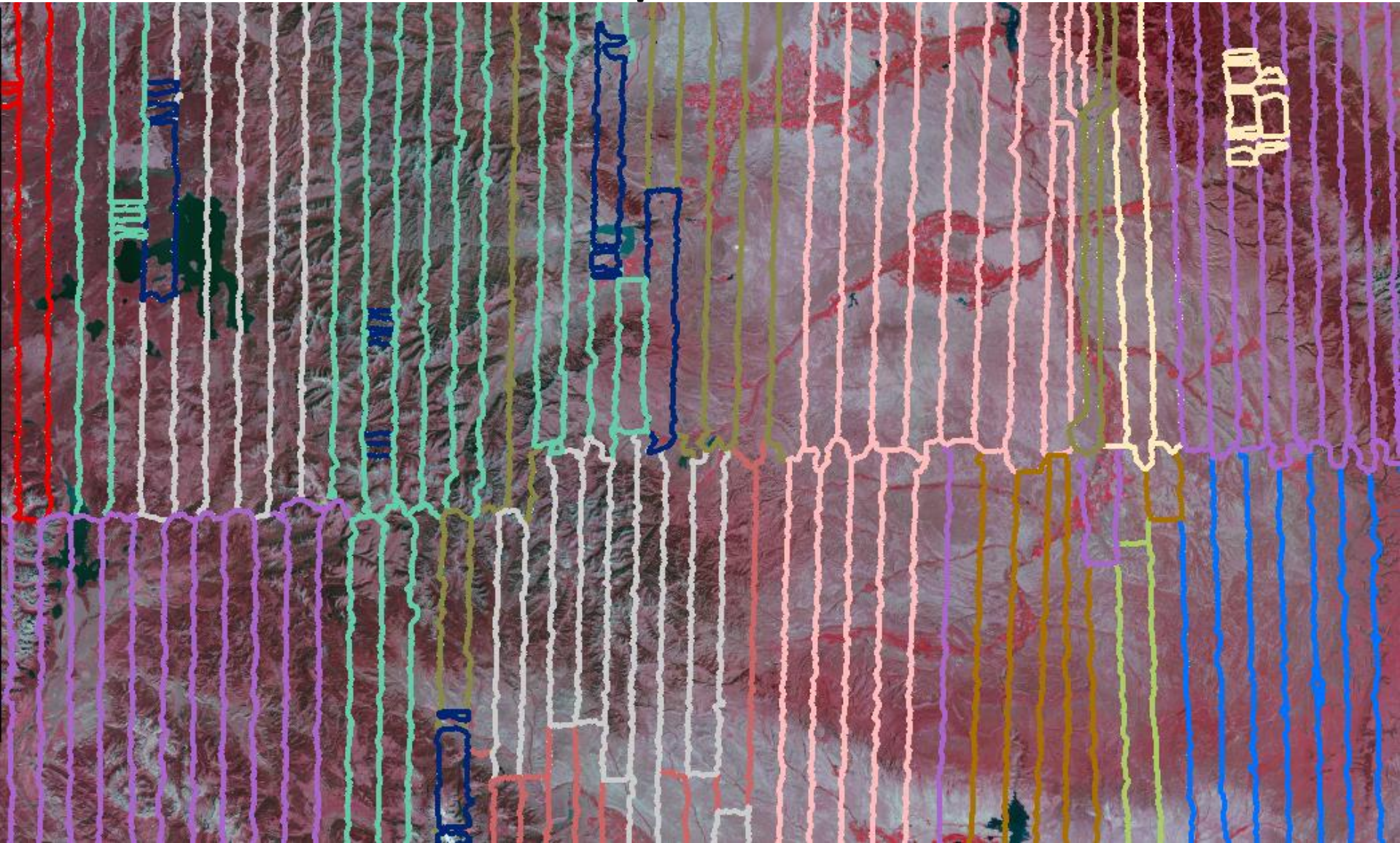
Each flight line limited to ~80 nautical miles
Inertial Measurement Unit (IMU) drift



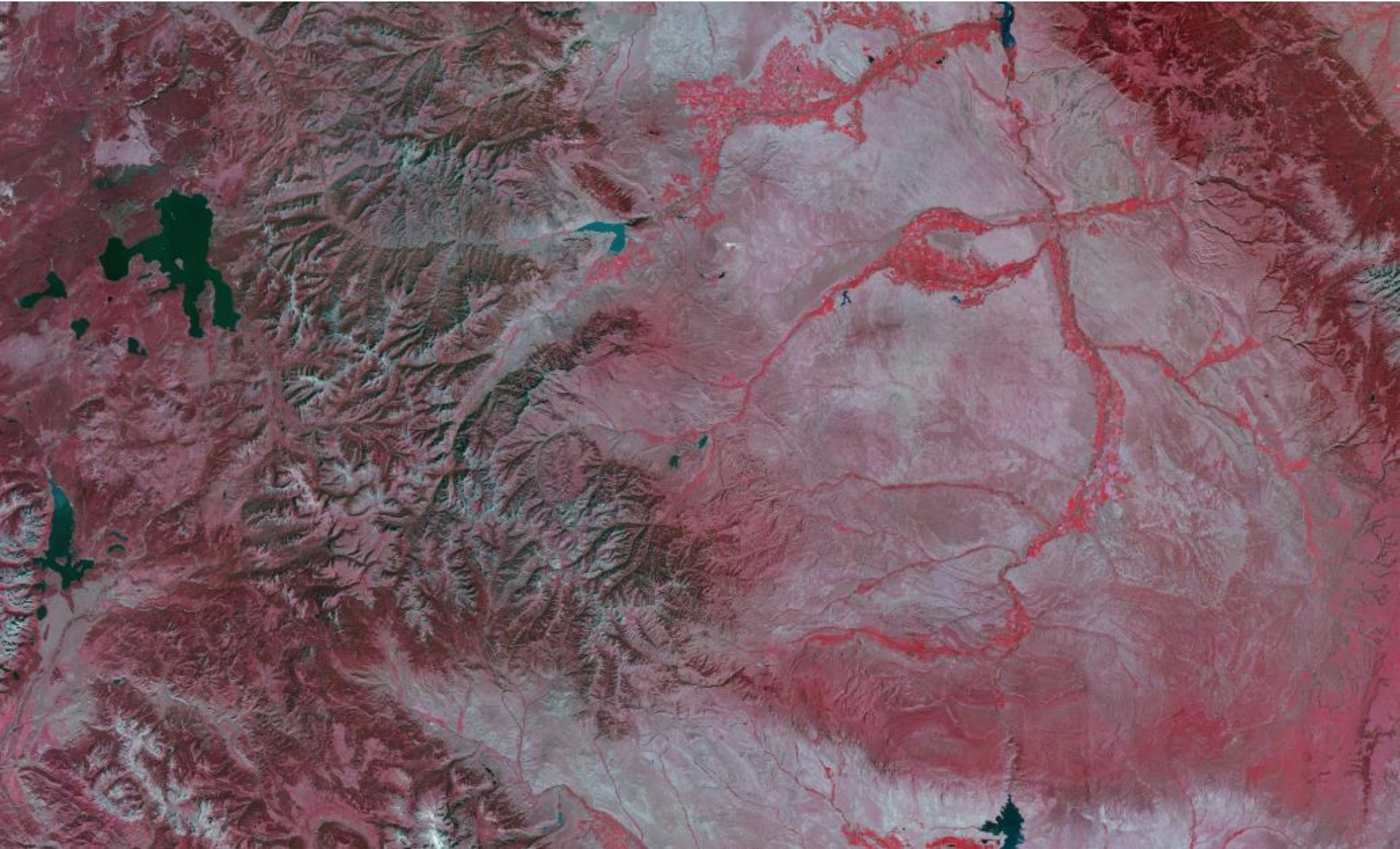
FlownDate

- 6/9/2015
- 6/12/2015
- 6/13/2015
- 6/17/2015
- 6/18/2015
- 6/20/2015
- 6/22/2015
- 6/23/2015
- 6/28/2015
- 6/29/2015
- 7/26/2015
- 7/28/2015
- 7/29/2015
- 7/30/2015
- 7/31/2015
- 8/9/2015
- 8/10/2015
- 8/11/2015
- 8/17/2015
- 9/8/2015
- 9/9/2015
- 9/10/2015
- 9/11/2015
- 9/12/2015
- 9/20/2015
- 9/21/2015
- 9/22/2015
- 9/23/2015
- 9/24/2015
- 9/25/2015
- 10/13/2015

Seamline shapefiles maintained to document acquisition metadata



Tone Balancing Multiple dates

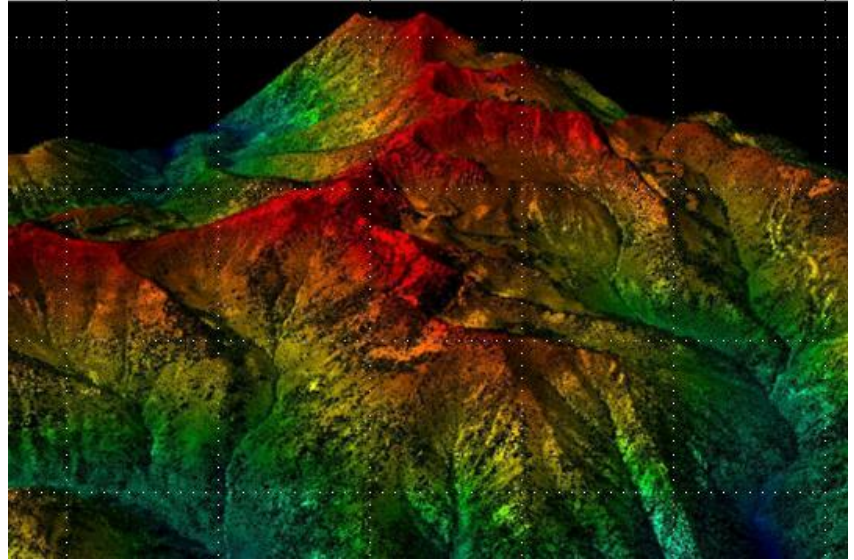


Wyoming NAIP 2015

- Buy up through consortium of BLM and several WY agencies

- Buy up costs:

— ½-meter	\$267,574
— Stereo Pairs	\$60,000
— Point Cloud	\$20,209



- Semi-Global Matching Derived Point Cloud at 2x pixel spacing
 - (0.8-1m posting)
- Estimated cost for Lidar for the state at QL2 is ~\$20 million

👁️ BLM will evaluate quality of point cloud

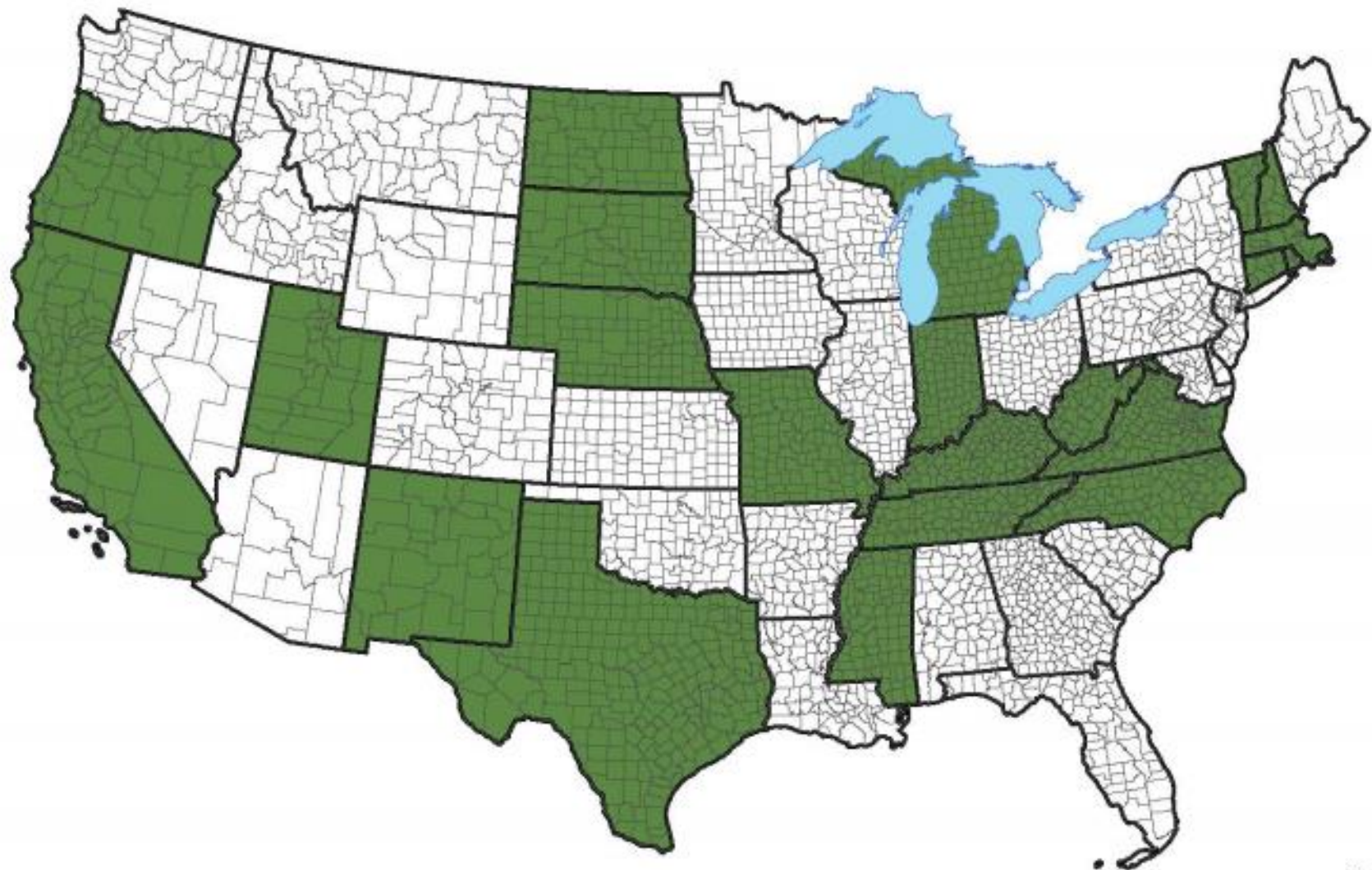
- 🧐 How much better is a \$20,000,000 Lidar point cloud then a \$20,000 Semi-Global Matching cloud?

Early Access Web Services: Provisional and Production

Early Access Web Services - Contractor hosted image services of provisional imagery from the NAIP Program

- imagery posted within five business days of acquisition
 - Not color corrected
 - Only ortho-rectified to 10 meters to true ground
 - Image Dates and Seamlines available as vector web service
 - Production Level NAIP Imagery will also be posted when completed
 - Service Links via ArcGIS Server (Rest Only)
 - <https://naip.nwgeo.com/arcgis/services>
 - <https://eaws.photoscience.com/arcgis/services>
 - <https://gissvr.surdex.net/arcgis/services>

2016 NAIP Planned Acquisition



National Resources Inventory

**A statistical survey of land use and
natural resource conditions and
trends on U.S. non-Federal lands.**

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/nri/>

Hawaiian Islands Update Orthoimagery Status, Version 3 February 2016

Hawaiian Islands Imagery Status

- New Imagery for the Hawaii Islands was just completed by NRCS in early February 2016.
- All Imagery is acquired with DigitalGlobe WorldView-2 or 3, has a .4 - .5 meter resolution and with 8 Multi-Spectral bands.
- New Imagery will be available by March 4th, 2016.

Niihau

Kauai

Oahu

Molokai

Maui

Lanai

Kahoolawe

Hawaii
Island

New Orthoimagery Acquisition Goal for Hawaiian Imagery



Molokai 2010



Molokai 2015

- With increased water penetration with the “Coastal Blue” band of WorldView-2 & 3, USDA has requested larger AOI’s for areas with shallow water reefs.

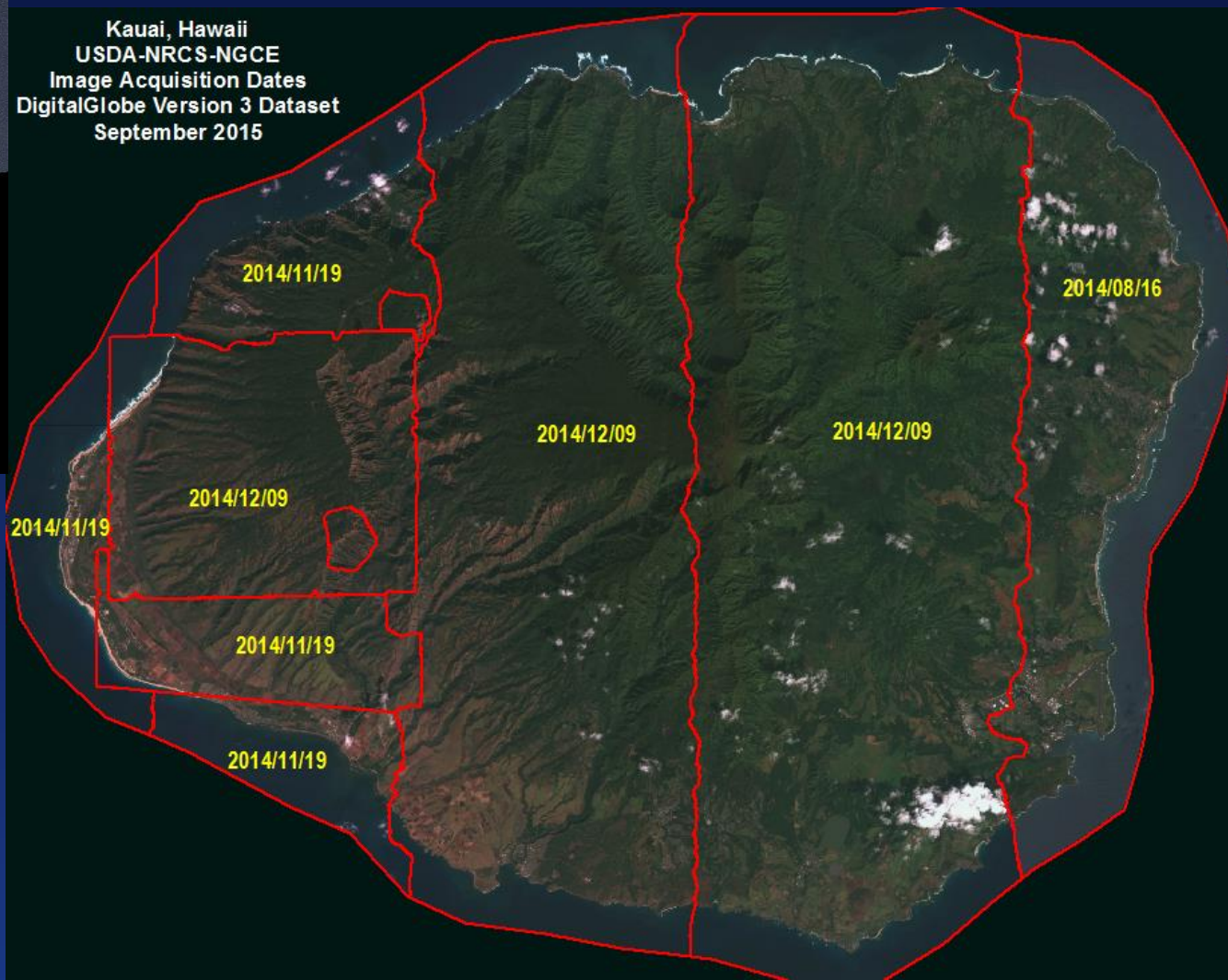
Niihau with Lehua, Hawaii
Acquisition Date - 02/27/2013
DG WorldView-2

Department of Agriculture
Conservation Service



Kauai and Niihau

Kauai, Hawaii
USDA-NRCS-NGCE
Image Acquisition Dates
DigitalGlobe Version 3 Dataset
September 2015

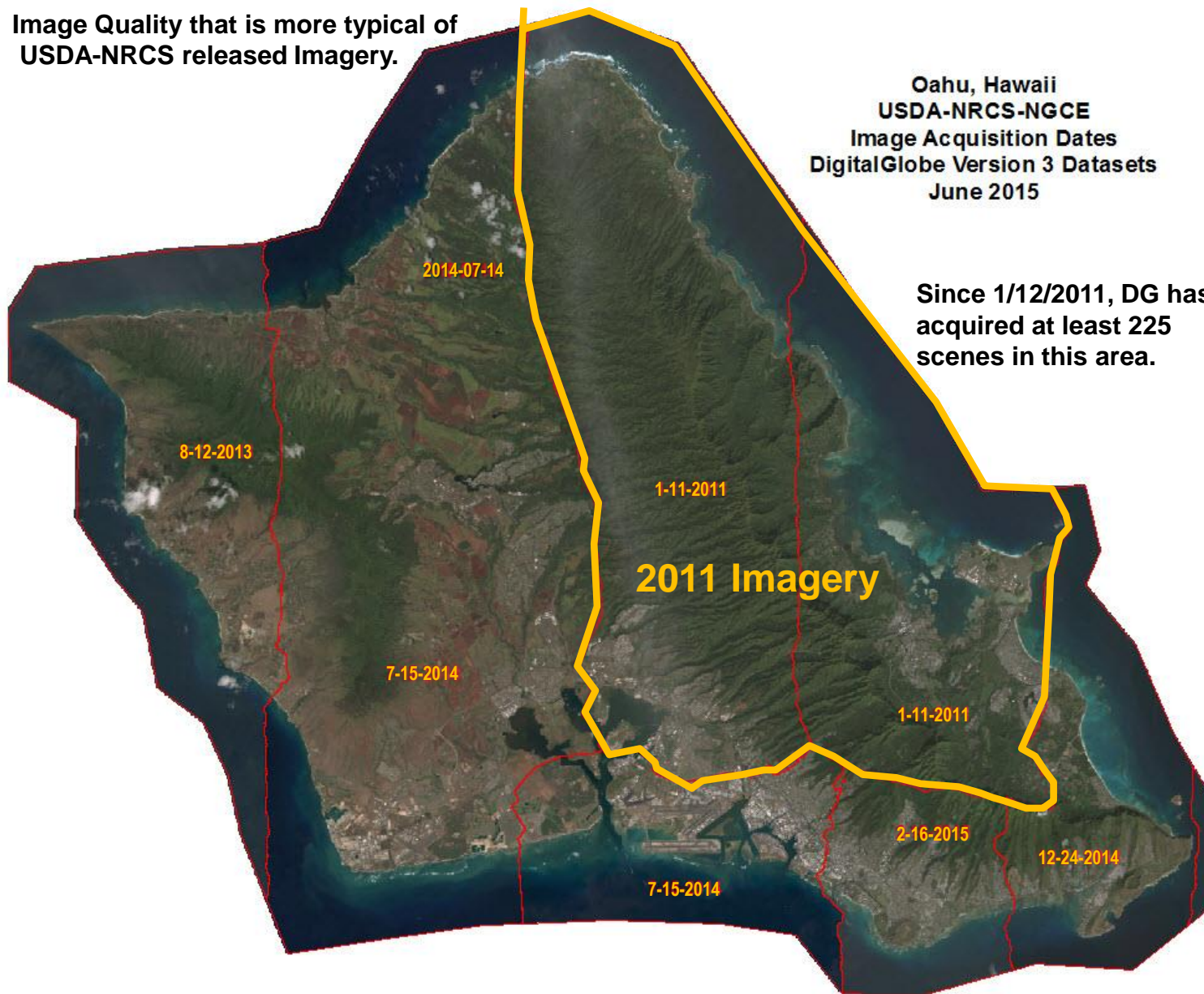


Kauai Imagery is a
combination of WV 2 & 3

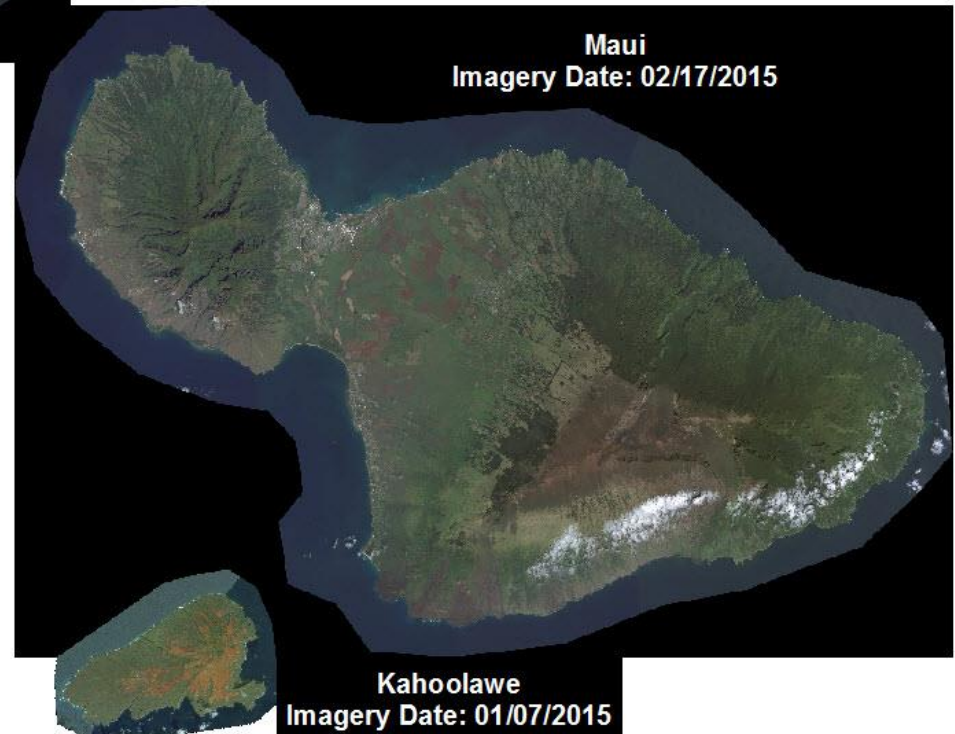
Image Quality that is more typical of
USDA-NRCS released Imagery.

Oahu, Hawaii
USDA-NRCS-NGCE
Image Acquisition Dates
DigitalGlobe Version 3 Datasets
June 2015

Since 1/12/2011, DG has
acquired at least 225
scenes in this area.



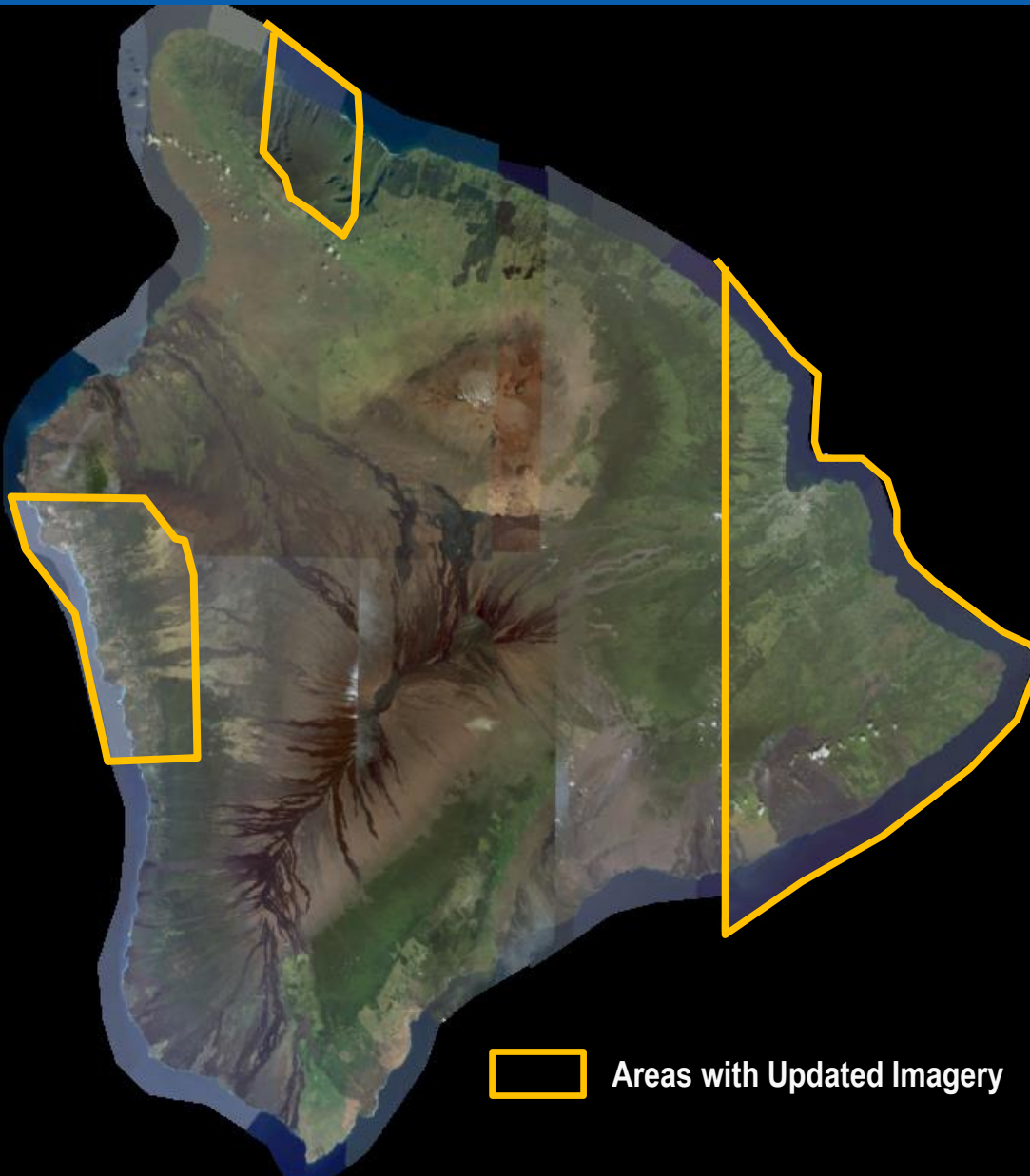
Maui County, Hawaiian Islands
Orthoimagery Status, Version 3
June, 2015



All Imagery is DigitalGlobe WorldView 2 or 3
Resolution = .4 - .5 Meters
License = Enterprise Premium

Source: USDA NRCS National Geospatial Center of Excellence, Fort Worth, Texas 2015

The new Maui and Lanai Imagery datasets are some of the best Imagery we have ever acquired!



Hawaii Island Version 3 February 2016

- Over 80% of the Island will be acquired in 2014-2016.
- Hilo-Puna area on the east end of the island is new (1/9/2016) Imagery.
- Kona and south will be clear for first time on USDA released Imagery.
- North-West will be nearly cloud free.

US Pacific Basin Orthoimagery, Version 2

- Commonwealth of the Northern Mariana Islands*
 - Guam
 - American Samoa
 - Marshall Islands
 - Federated States of Micronesia
 - Palau
 - Minor Outlying Territories (Palmyra, Wake, Kingman's Reef etc..)
 - *North West Hawaiian Islands (Available from NOAA)*
-
- ALL areas were collected for the above US Pacific Basin areas including most shallow water reef areas.
 - New Imagery data is being collected in 2015-2016 under contract for the following areas:
 - Guam and Commonwealth of the Mariana Islands
 - American Samoa
 - Marshall Islands
 - Federated States of the Micronesia (Areas damaged by Typhoon Maysak)

NRCS has taken the lead to create image bases for Pacific Basin

Partnership: USDA-NRCS, USDA FS, and NOAA

Purpose: Acquire base imagery for Hawaii and US Territories in the Pacific Basin

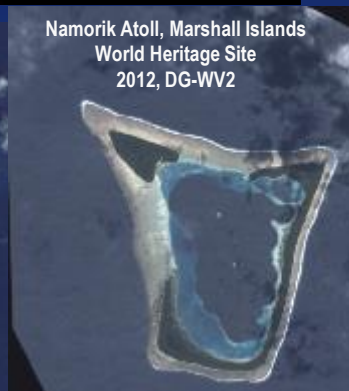
1 meter or better

Aerial (4-band, WV2 / Digital Globe, Pléiades / Airbus)

Enterprise Premium License:

Allows for non-commercial use

Use in Public Web Mapping Services





Guam 2013
DG-WV2



Guam 2013
High Resolution
Aerial and High
Resolution
Satellite/Astrium-
Pleiades



Agrihan, CNMI
2013
DG-WV2



Agrihan, CNMI
2013
DG-WV2



Pagan, CNMI 2012
DG-WV2



Alamagan, CNMI 2012
DG-WV2



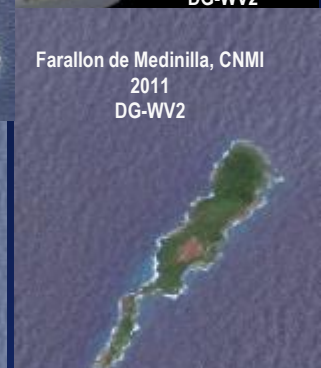
Guguan, CNMI
2013
DG-WV2



Asuncion, CNMI
2012
DG-WV2



Farallon de
Pajaros, CNMI
2012
DG-WV2



Farallon de Medinilla, CNMI
2011
DG-WV2



Saipan, CNMI
2013
DG-WV2



Tinian, CNMI
2012
DG-WV2



Sarigan, CNMI 2013
DG-WV2

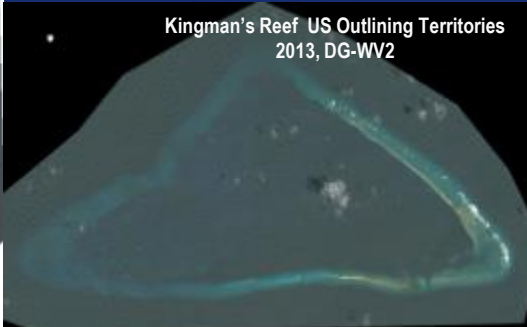


Farallon de
Pajaros, CNMI
2012
DG-WV2



Rota, CNMI 2013
DG-WV2

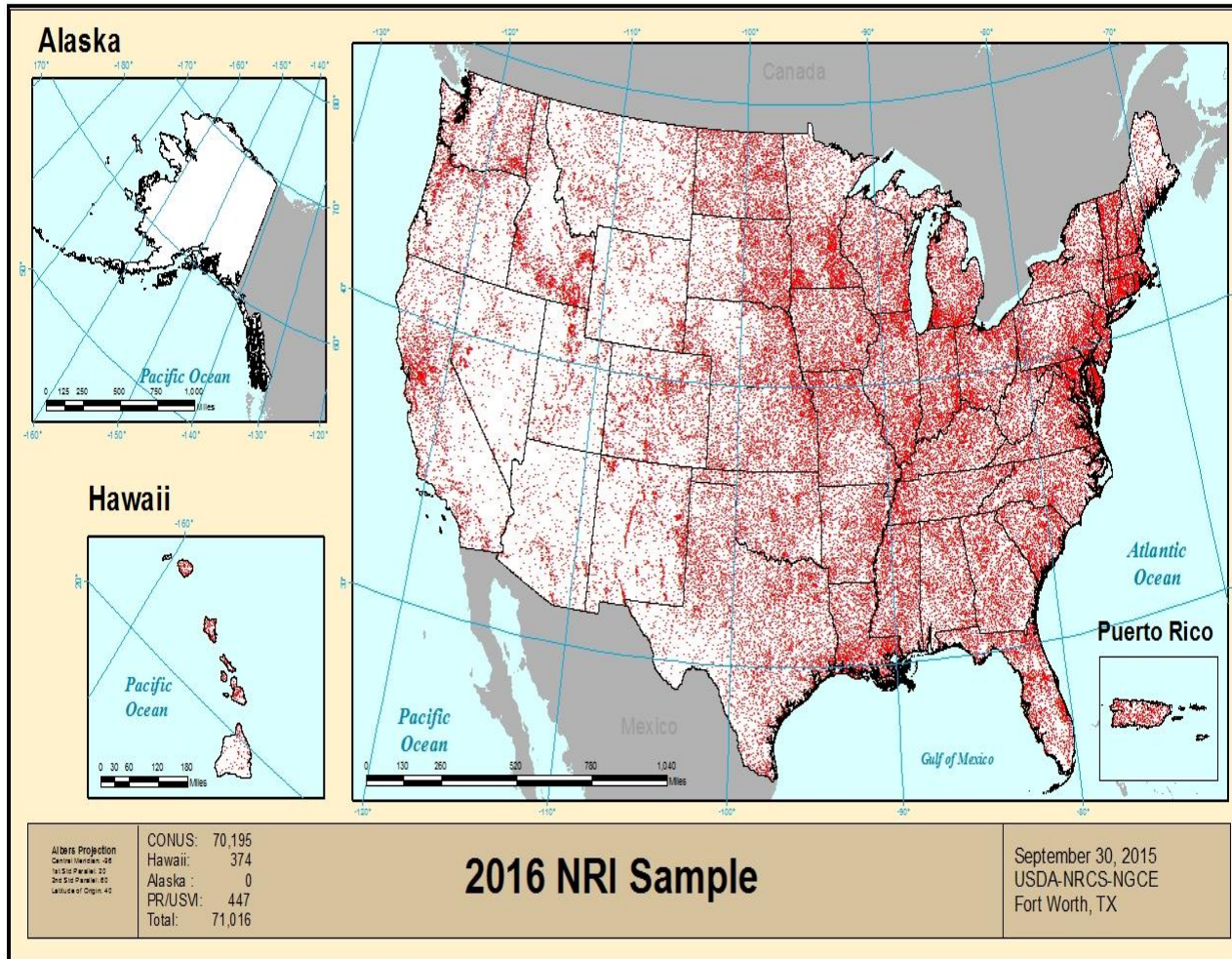
Pacific Basin Orthoimagery USDA-NRCS-NGCE



Kingman's Reef US Outlying Territories
2013, DG-WV2



Rota, CNMI 2010-2012
DG-WV2



9" x 9" analog film acquisition.

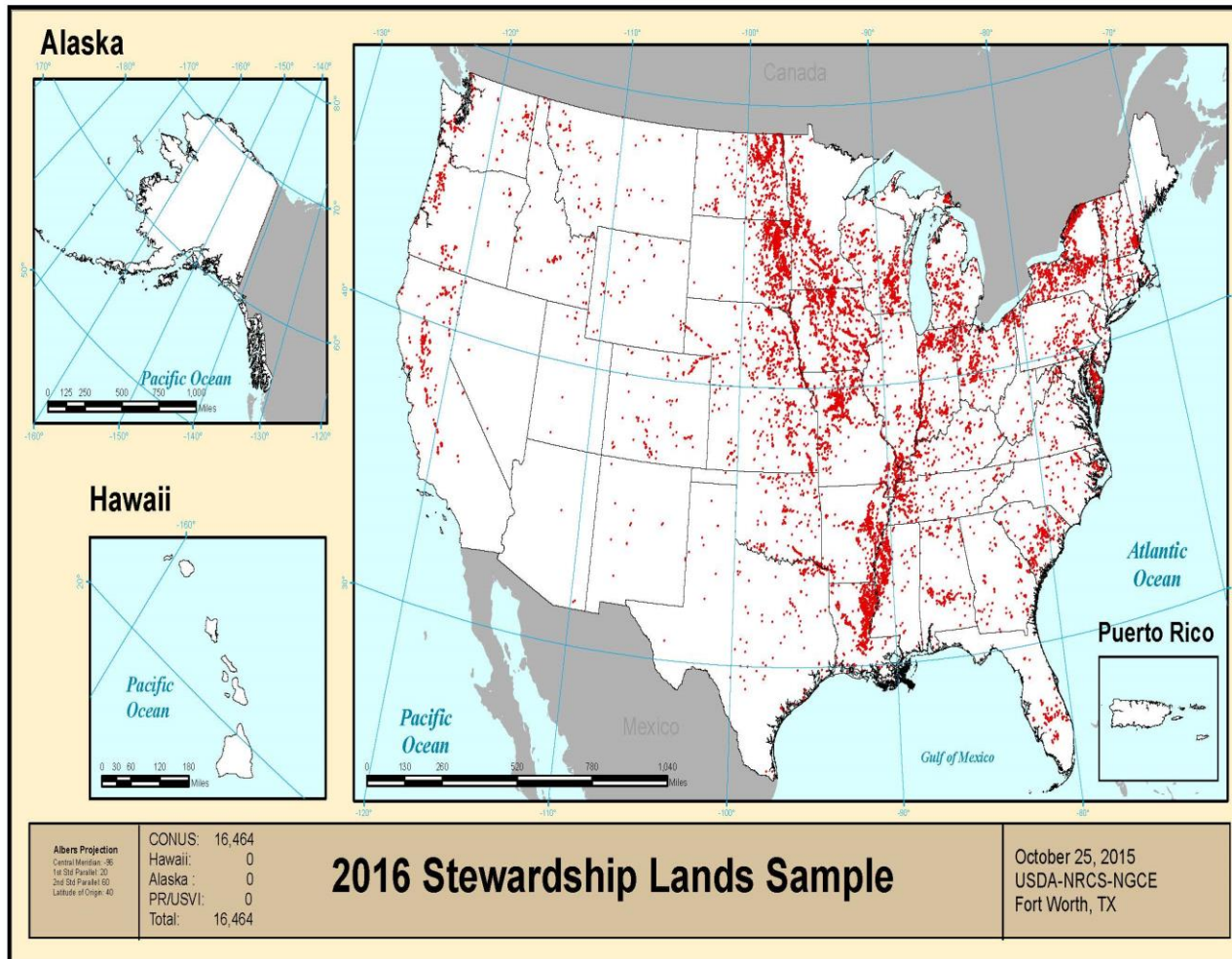
Color negative film still available.

Film is scanned by vendor and rectified by NRCS.

Use for data collection in the National Resources Inventory Program.

5 vendors used for imagery acquisition.

\$7.487 million in task orders for 2016.



9" x 9" analog film acquisition or 15-cm GSD, 4-band digital imagery.

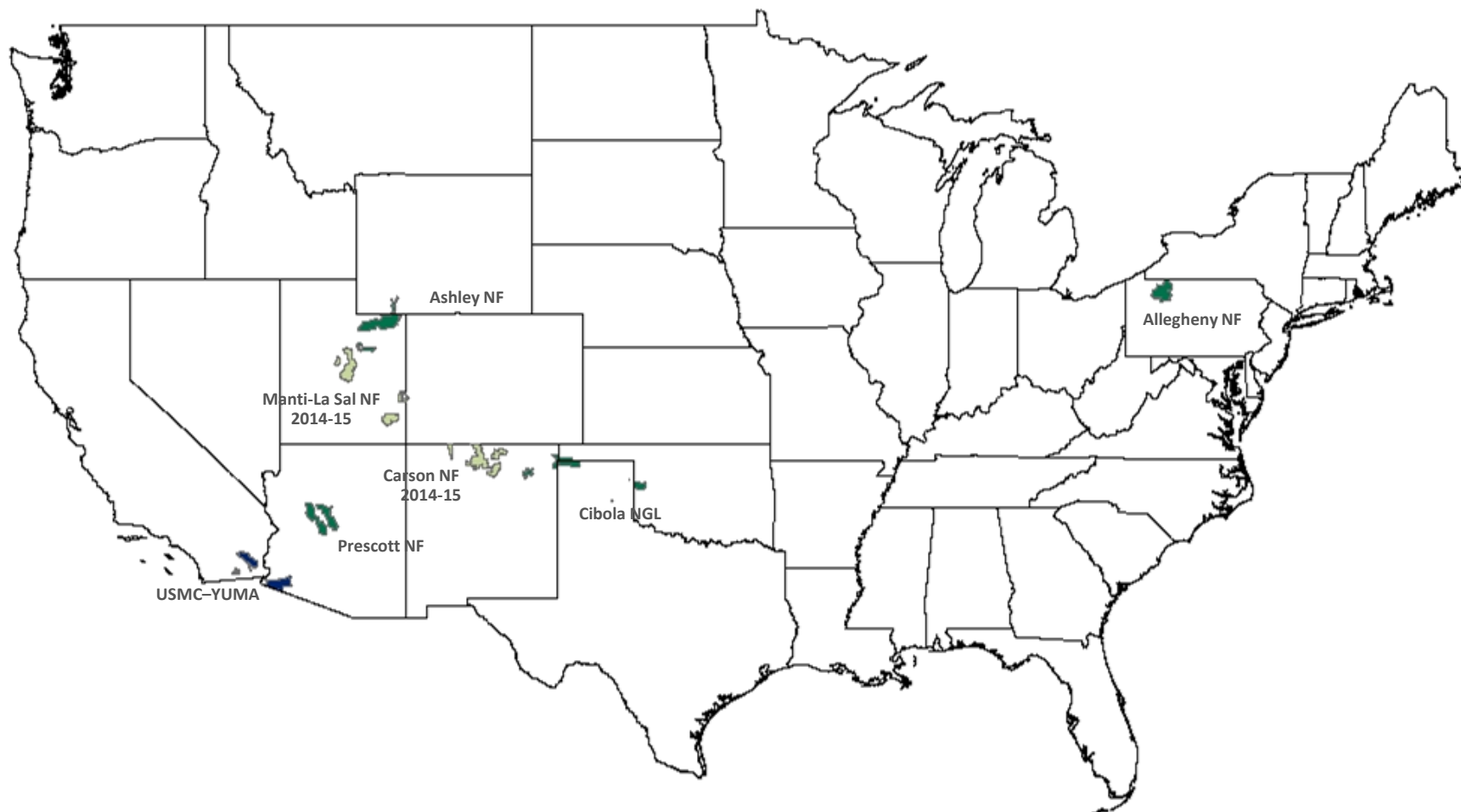
Film specifications same as NRI.

Used for monitoring Stewardship Lands Easements. About 3.158 million acres.

5 vendors used for collection.

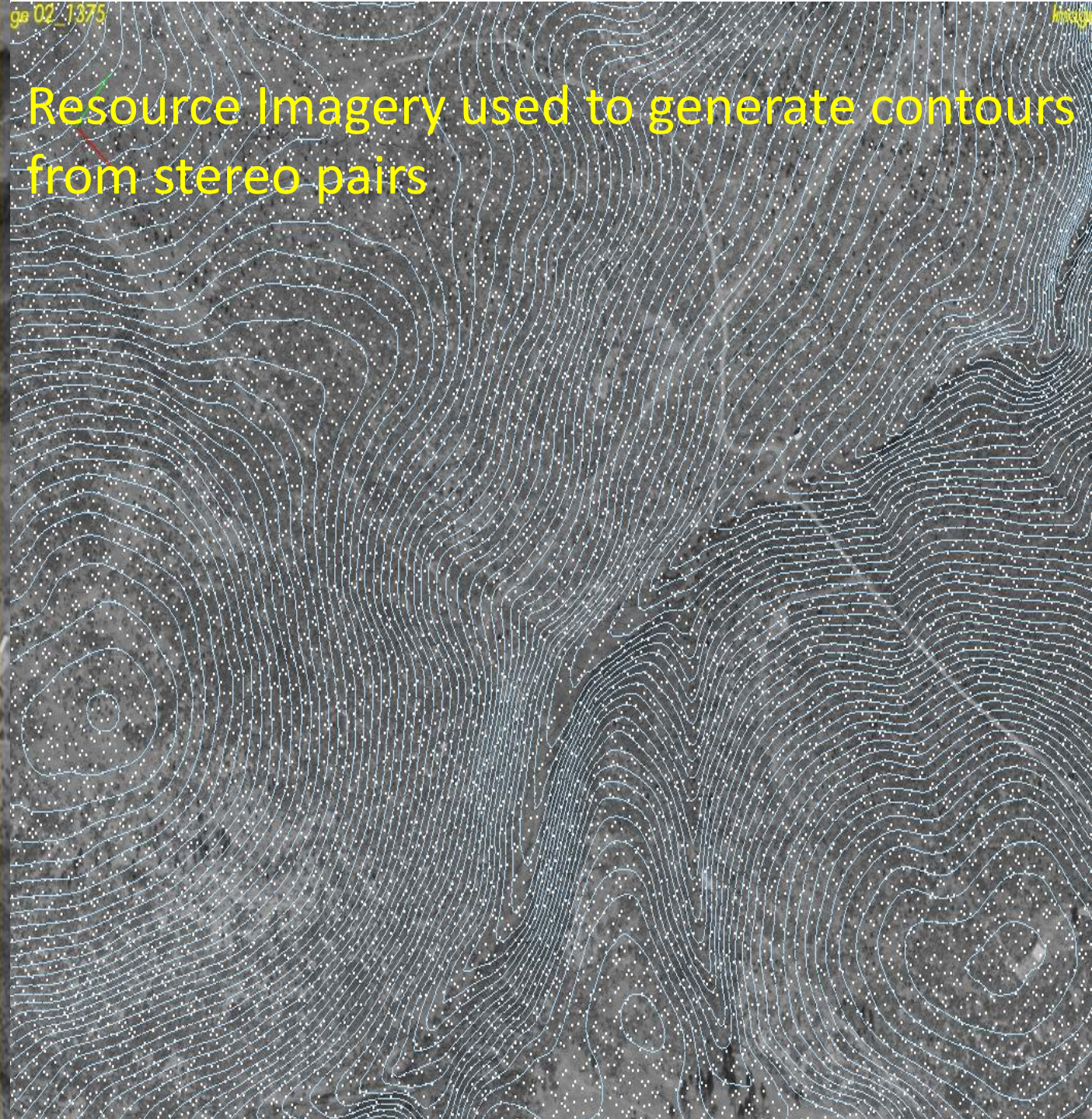
\$2.910 million in task orders for 2016.

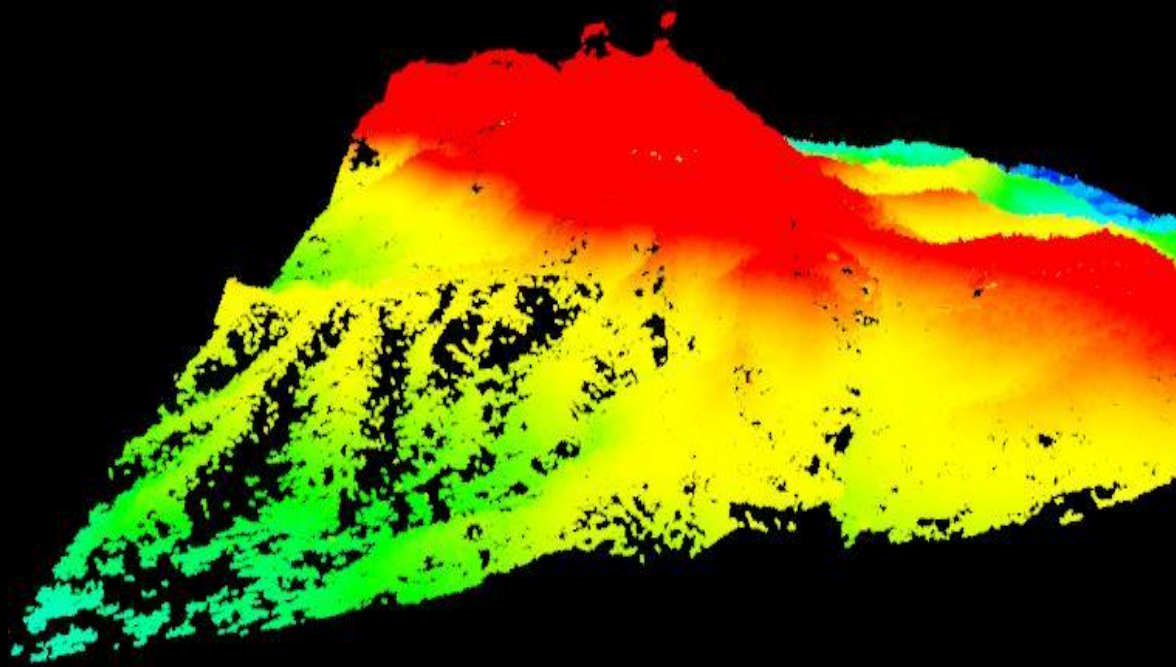
2015 Resource Imagery



- *Six areas totaling 9,427 square miles*
 - *Digital - stereo and ortho*
 - *25cm and 30cm*

Resource Imagery used to generate contours
from stereo pairs





Documentation through time: evidence in court, change detection, site preparation, hydrologic analysis and much more.
This is Chimney Rock NM on the San Juan National Forest



DISASTERS

Name: SabineRiverFlood_20160312_DSC_0296.JPG

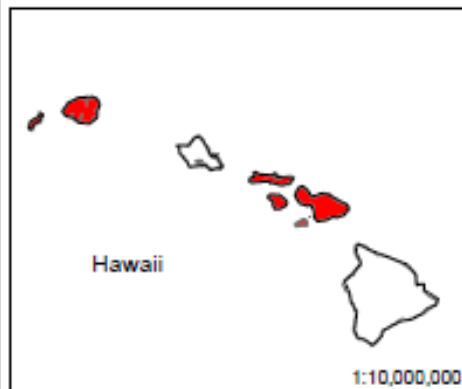
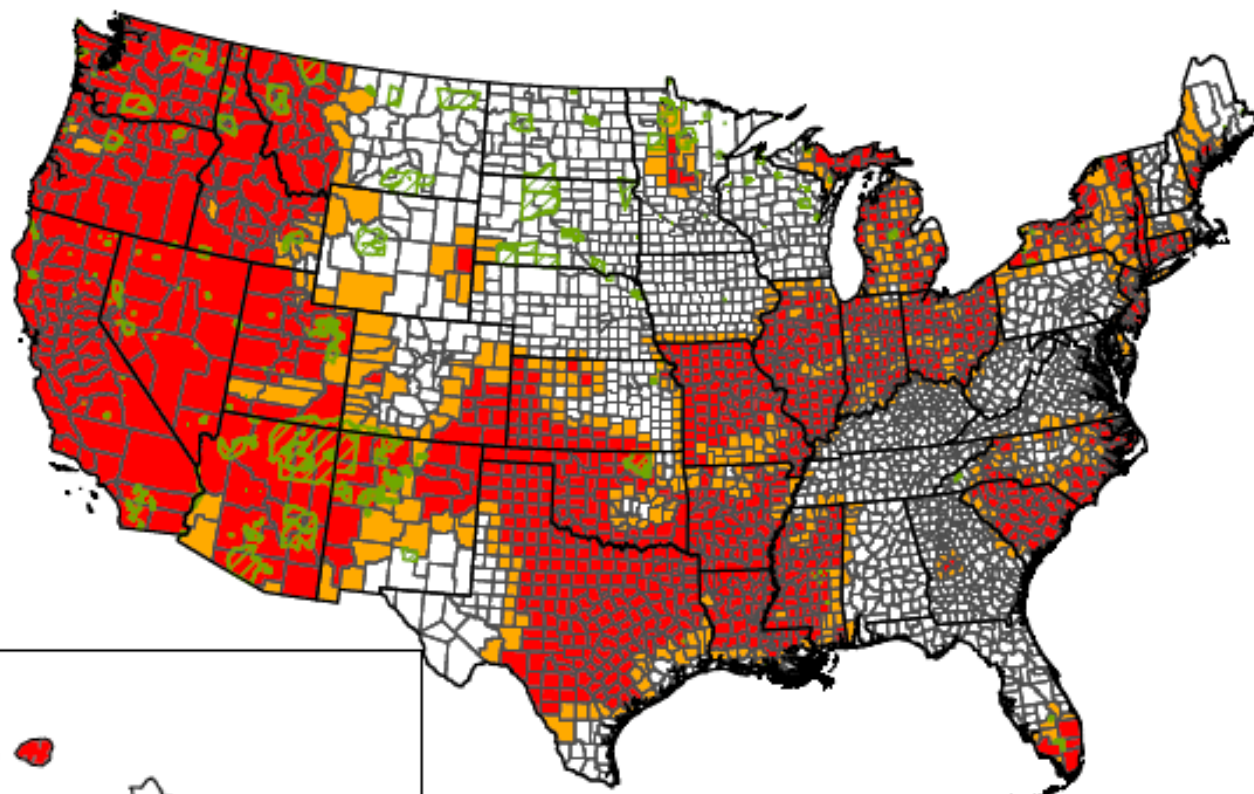


Date/Time 2016-03-12 17:03:39
Altitude 331 meters above sea level
Latitude N 31 deg 3'29.214
Longitude W 93 deg 30'40.896








Secretarial Disaster Designations - CY 2015

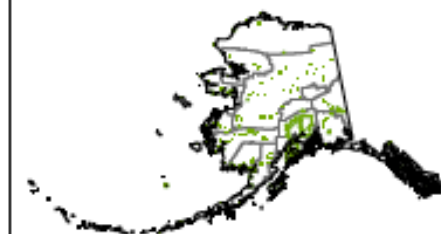
Primary and Contiguous Counties Designated for 2015 Crop Disaster Losses



All Secretarial Designations as of November 25, 2015
Total All Crop Approved Designations

-  State Boundary
-  County Boundary
-  Tribal Lands
-  Primary Counties: 1222
-  Contiguous Counties: 565

1:25,000,000



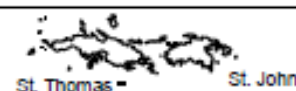
Alaska

1:60,000,000



Puerto Rico

1:4,000,000



Virgin Islands of the U.S.

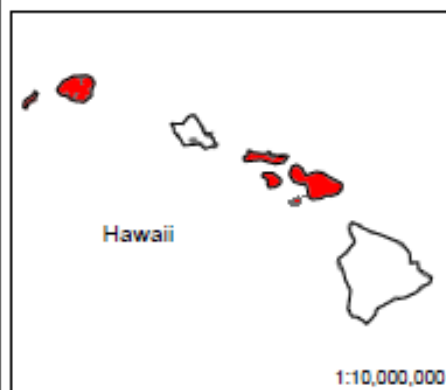
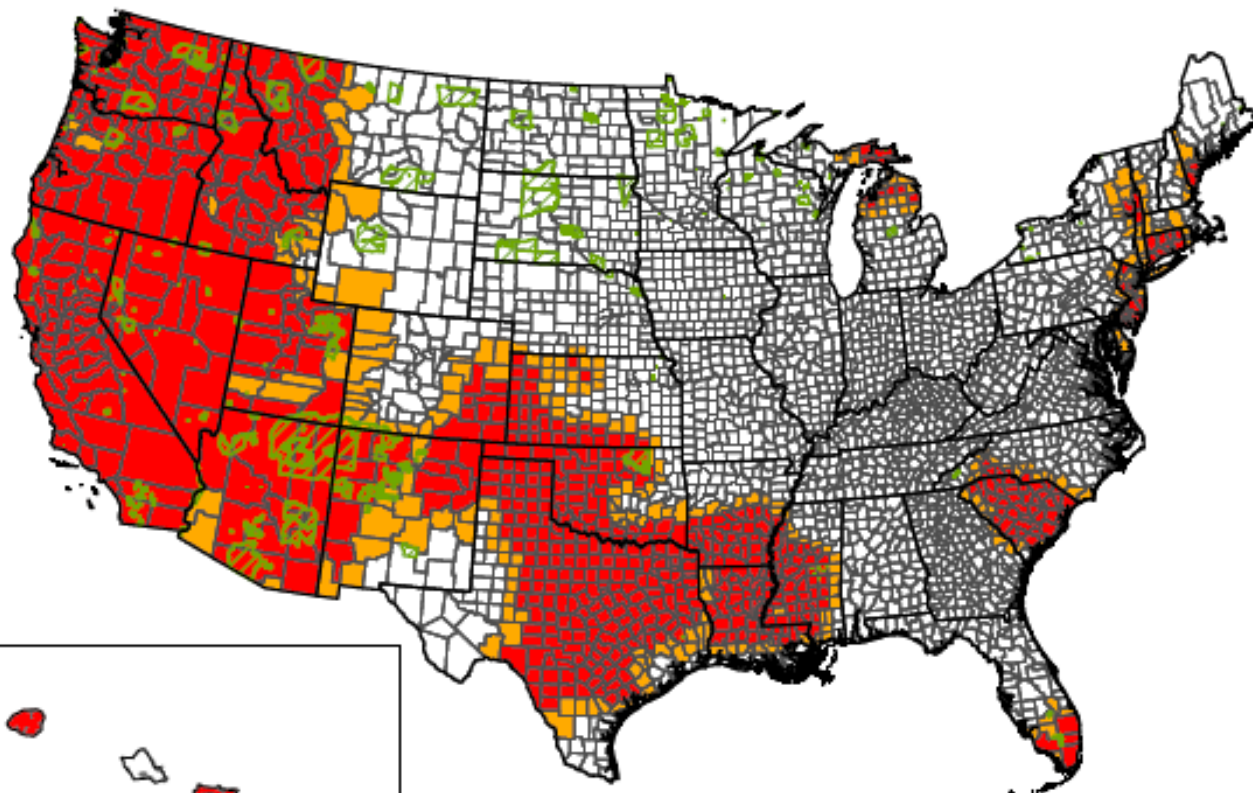


1:1,500,000








USDA Farm Service Agency
Production, Emergencies and Compliance Division
Washington, D.C.
November 25, 2015

2015 Secretarial Drought Designations - All Drought

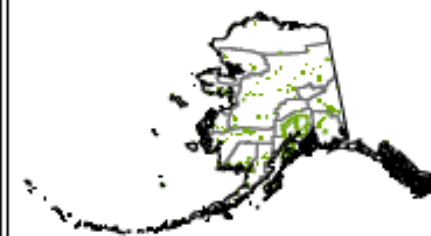


USDA Farm Service Agency
Production, Emergencies and Compliance Division
Washington, D.C.
November 25, 2015

Secretarial Drought Designations for 2015
Disaster Incidents as of November 25, 2015

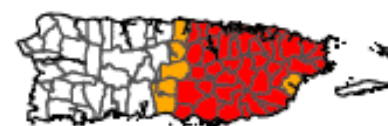
-  State Boundary
-  County Boundary
-  Tribal Lands
-  Primary Counties: 748
-  Contiguous Counties: 282

1:25,000,000



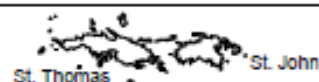
Alaska

1:60,000,000



Puerto Rico

1:4,000,000



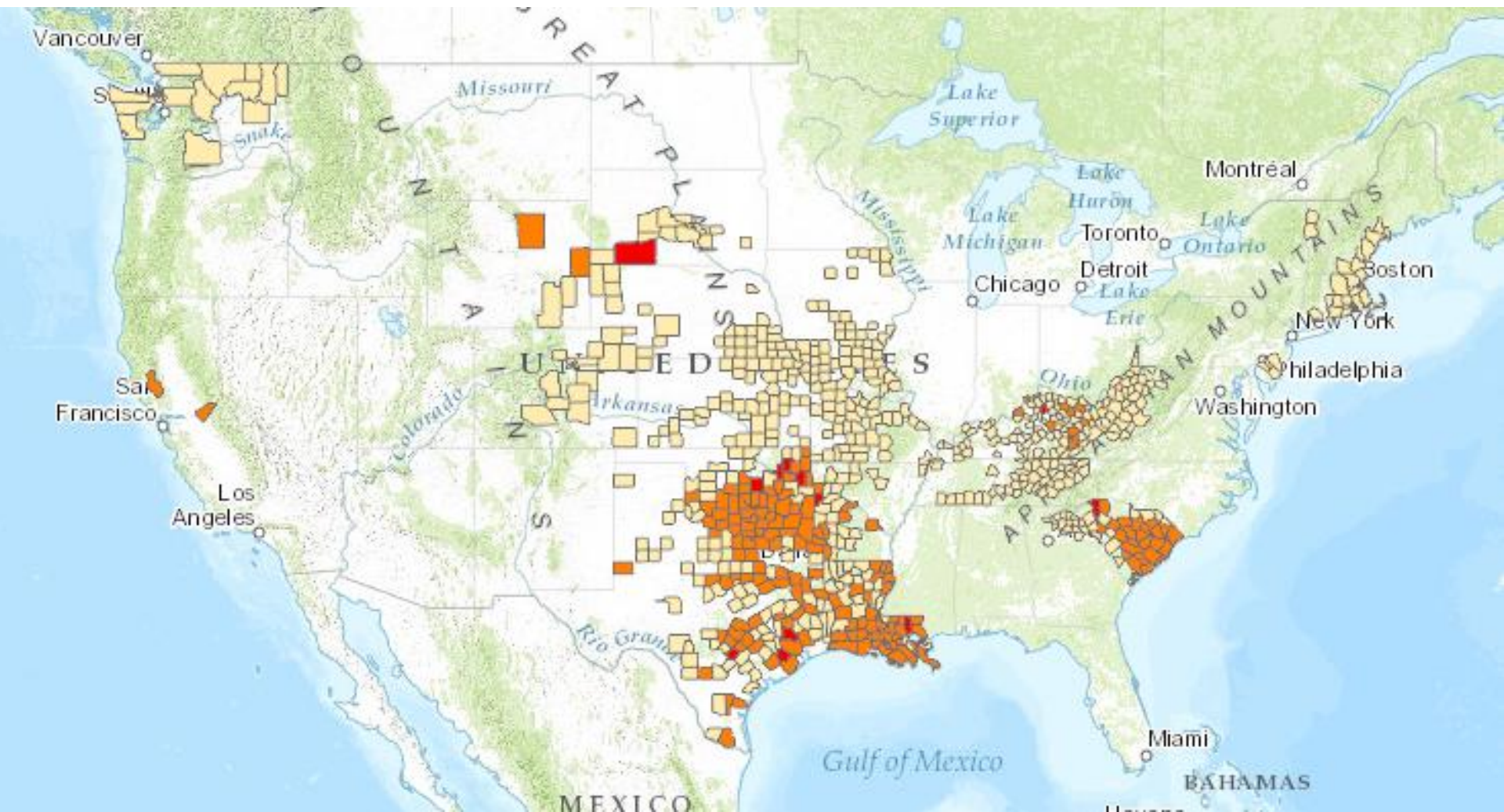
Virgin Islands of the U.S.

St. Croix



1:1,500,000

Presidential Disaster Declarations for 2015



Fire



2015 Statistics

- 10.1 million acres burned, 153% of the ten year average
- 5.1 million acres in Alaska, 444% of ten year average for AK
- Bi-Modal – Alaska in June/July then CONUS in August
- Unprecedented ordering of NIROPS
- Extensive use of Firehawk (aka: Aircraft 3)





Forest Service Active Fire Monitoring Satellites

Relative Ground Swath



GOES Imager

Fire detection spatial resolution **4000m**
Temporal resolution: **Every 15 min**

> 8000 km swath (entire Earth disk)



GOES R/S ABI

Fire detection spatial resolution **2000m**
Temporal resolution: **Every 5 min**
Launch date: **GOES-R in early 2016**

> 8000 km swath (entire Earth disk)



VIIRS

Fire detection spatial resolution: **375m and 750m**
Temporal resolution: **Twice daily from one sensor**

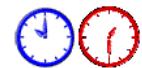
3000 km swath



AVHRR

Fire detection spatial resolution: **1100m**
Temporal resolution: **6 times daily from 3 sensors**

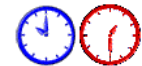
2700 km swath



MODIS

Fire detection spatial resolution: **1000m**
Temporal resolution: **4 times daily from 2 sensors**

2300 km swath



Landsat

Fire detection spatial resolution: **30m**
Temporal resolution: **Once every 16 days**

183 km swath



- GOES-R will provide enhanced, persistent fire detection and monitoring capabilities
- ★ **MODIS is the only available sensor designed with consideration for active fire detection and characterization**
- ★ **Loss of Terra MODIS impacts diurnal and long term fire detection/monitoring continuity available to fire community the past 15 years**
- Landsat and similar sensors (e.g. Sentinel 2) collectively will potentially provide spatially explicit fire detection data on a 1-2 day basis



Geostationary



Morning Orbit

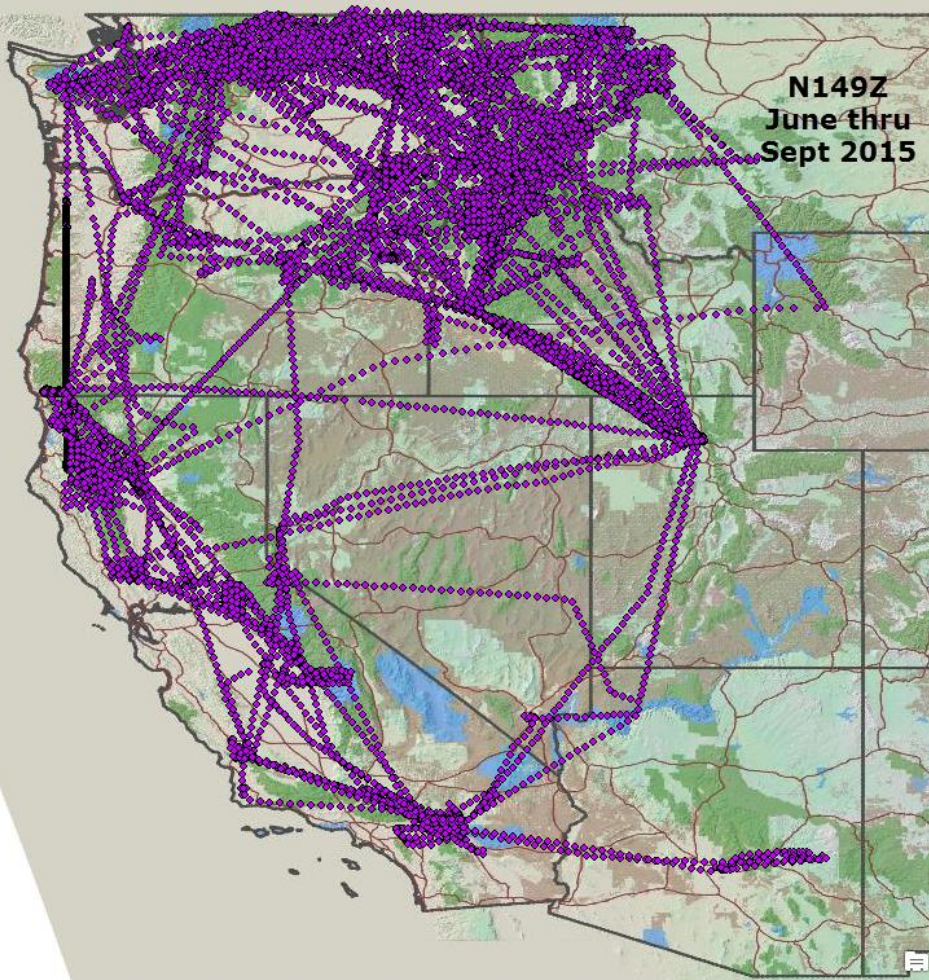


Afternoon Orbit

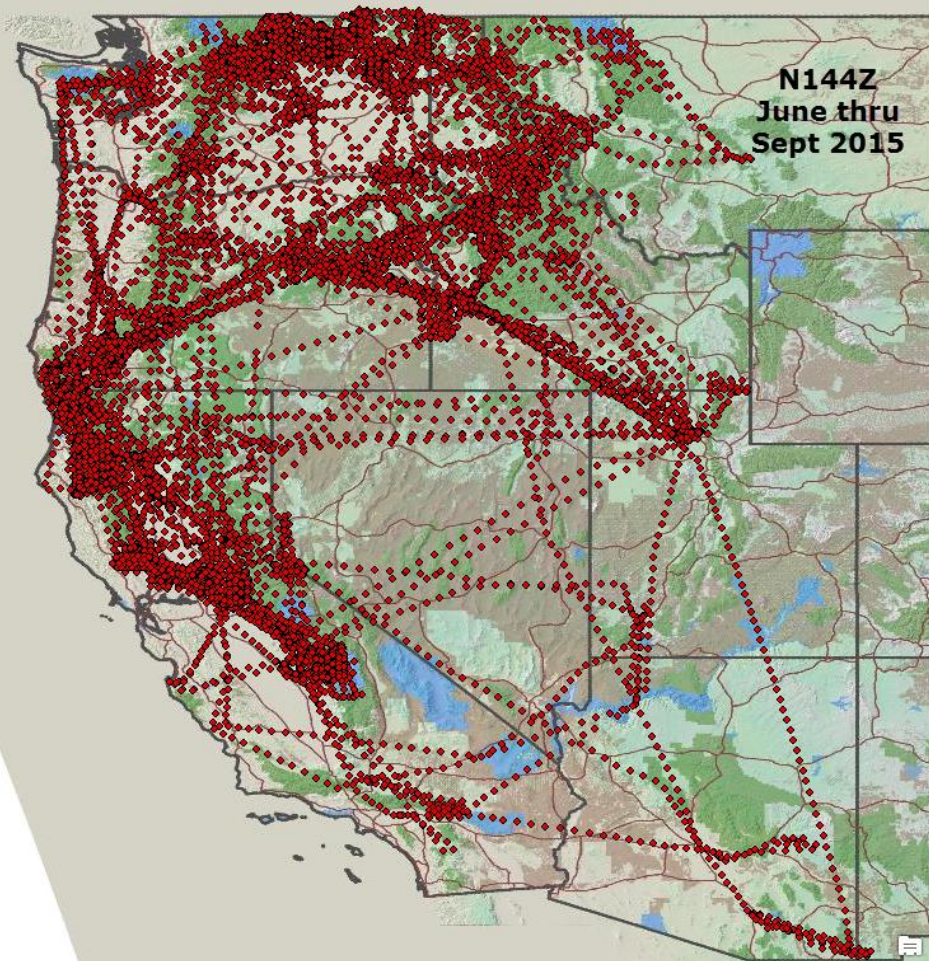
Two planes with thermal sensors used to map fire perimeters



**N144Z – 809 requests
filled**



**N149Z
June thru
Sept 2015**



**N144Z
June thru
Sept 2015**

**N149Z – 534 requests
filled**



Floods



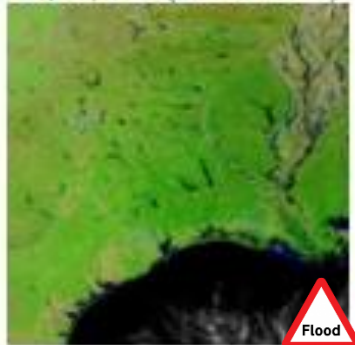
MODIS Terra, March 21, 2016

Crop Explorer

Select Satellite ▾

Satellite: terra.721 Region: r13c09 Year: 2016

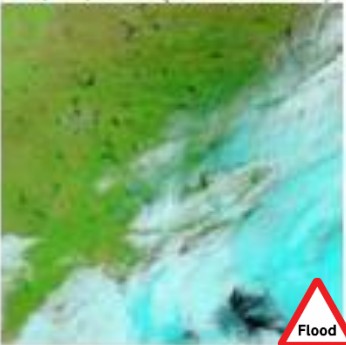
03/21/2016(081 of 2016)



03/20/2016(080 of 2016)



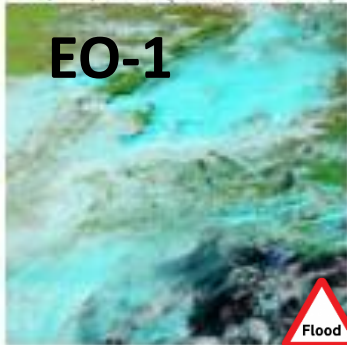
03/19/2016(079 of 2016)



03/18/2016(078 of 2016)



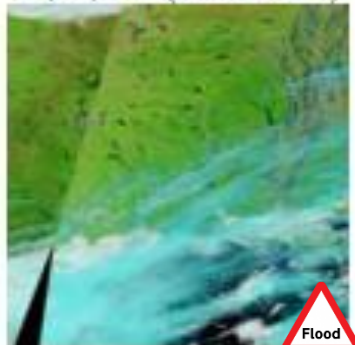
03/17/2016(077 of 2016)



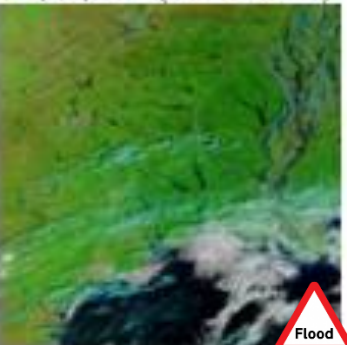
Landsat 8

EO-1

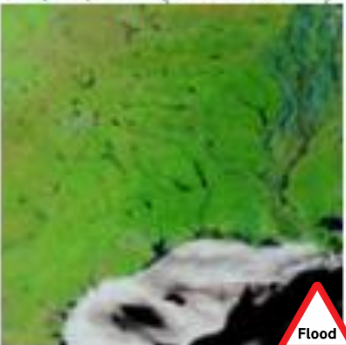
03/16/2016(076 of 2016)



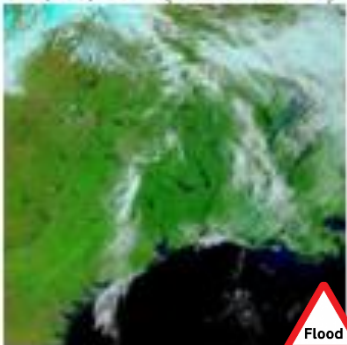
03/15/2016(075 of 2016)



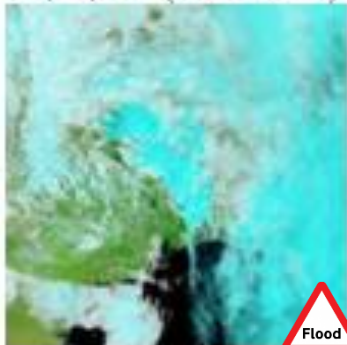
03/14/2016(074 of 2016)



03/13/2016(073 of 2016)



03/12/2016(072 of 2016)



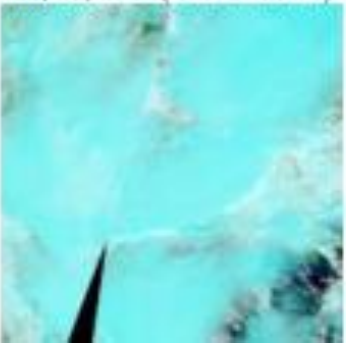
03/11/2016(071 of 2016)



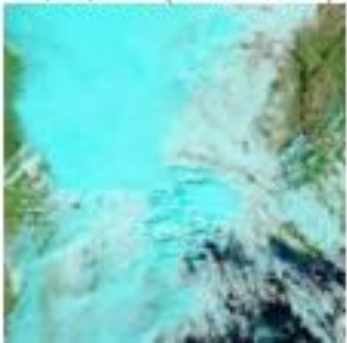
03/10/2016(070 of 2016)



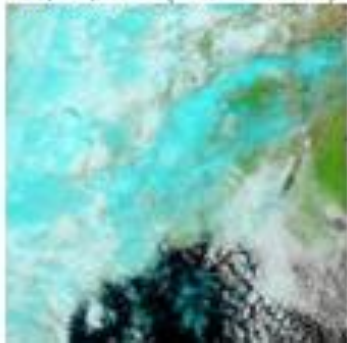
03/09/2016(069 of 2016)



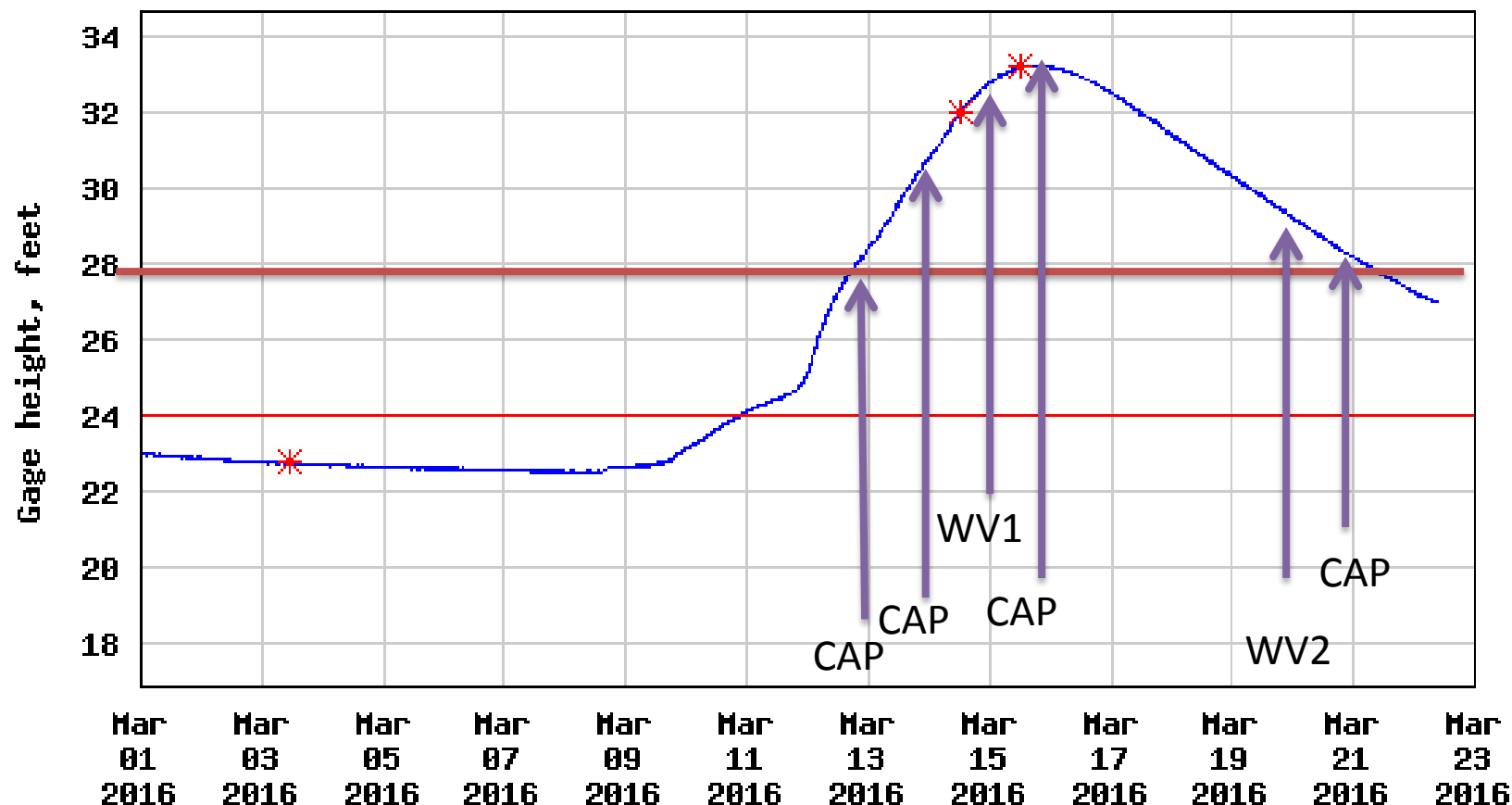
03/08/2016(068 of 2016)



03/07/2016(067 of 2016)



USGS 08030500 Sabine Rv nr Ruliff, TX



---- Provisional Data Subject to Revision ----

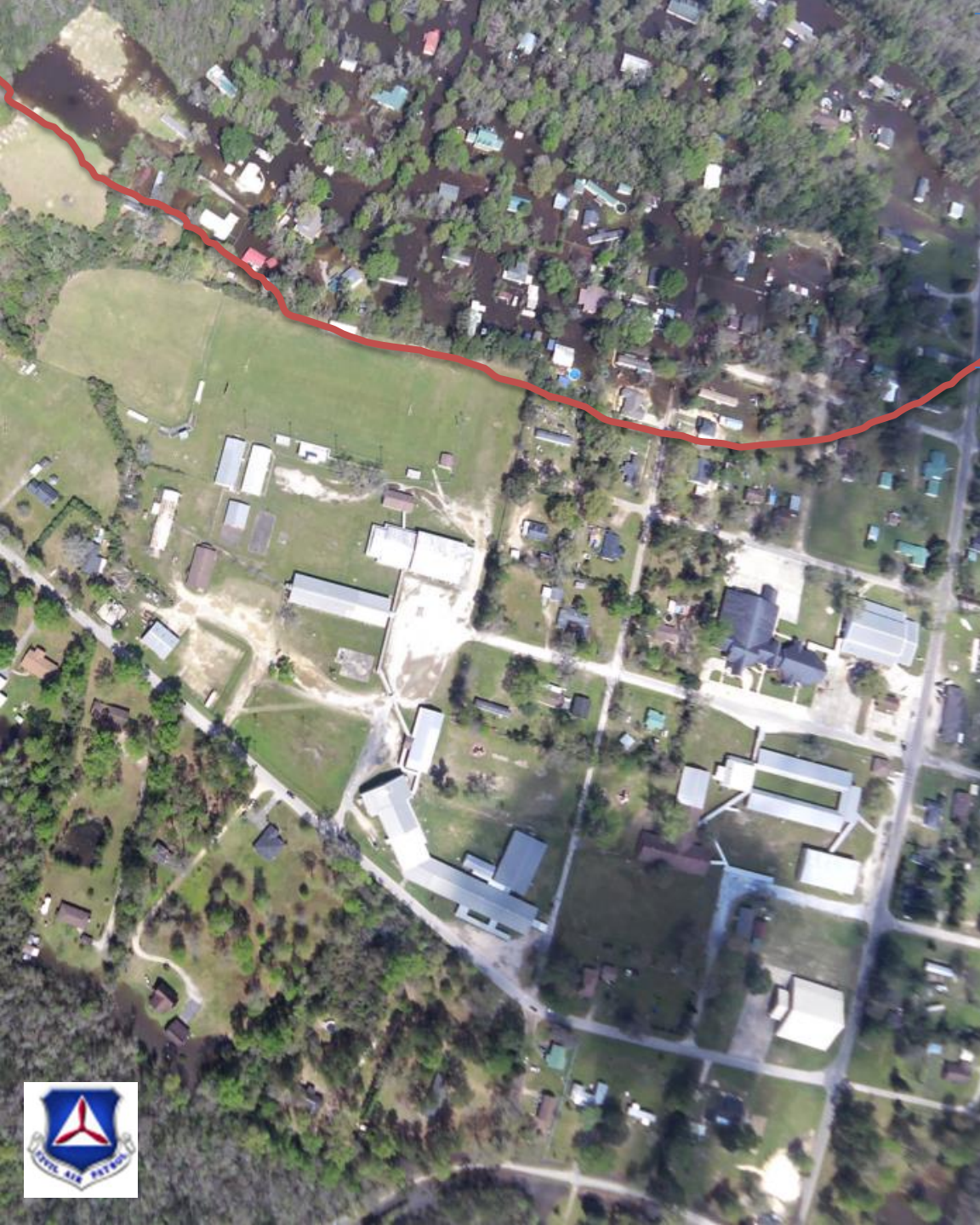
— Gage height * Measured gage height — NMS Flood Stage

Landsat and EO-1 unable to see the ground (clouds).

Major Flood > 28 Feet. Moderate Flood > 26 Feet Minor Flood > 24 Feet

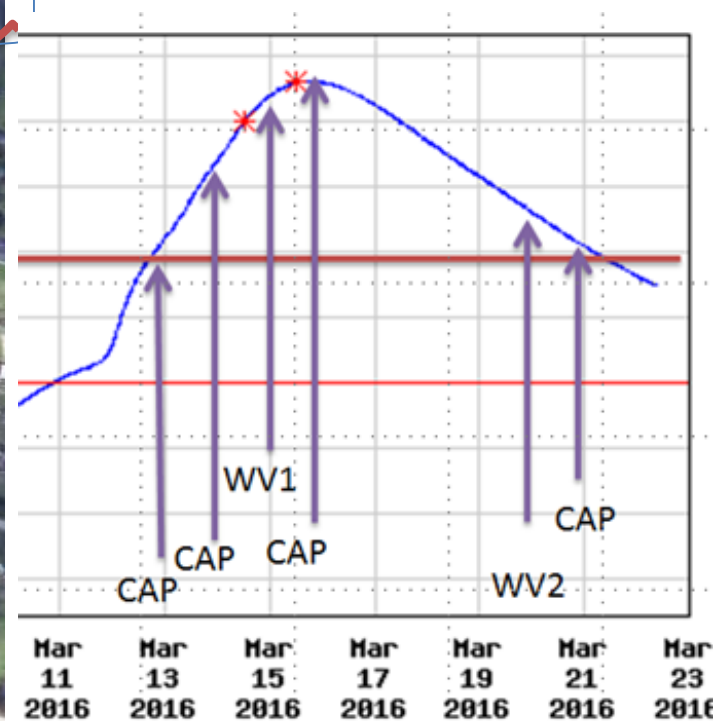
Deweyville, TX near Ruliff stream gauge on Sabine River





CAP March 13, 2016

Flood

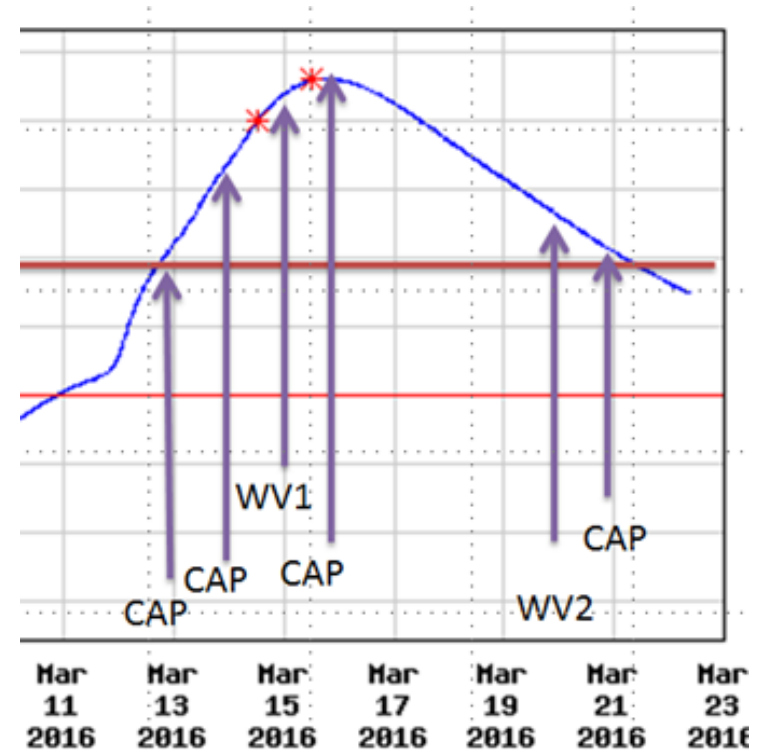


Date/Time: 2016-03-13 12:39:42

Img Direction: 350°

Altitude: 673 meters above sea level

CAP March 13, 2016



Date/Time: 2016-03-13 12:48:43

Img Direction: 184°

Altitude: 734 meters above sea level

Latitude: 30.294919

Longitude: -93.748503

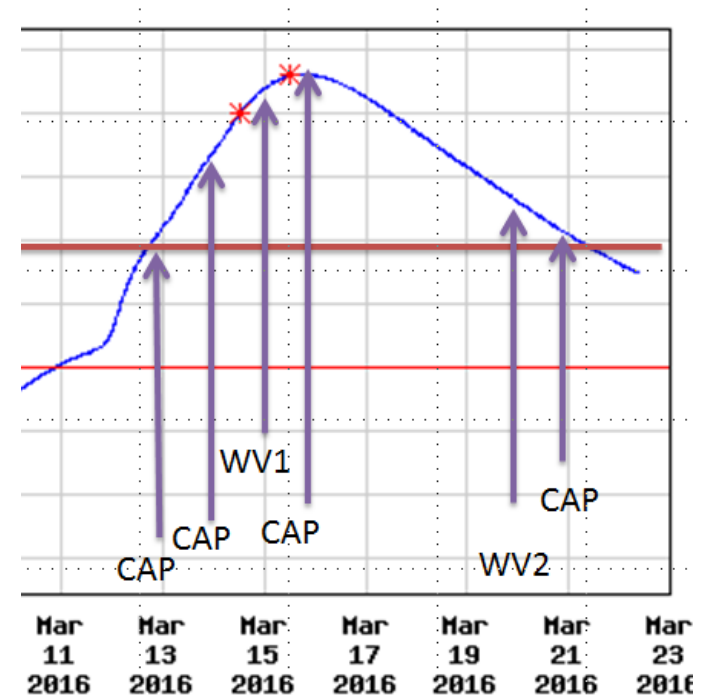
Ground Speed: 116 mph

http://web.corral.tacc.utexas.edu/CSR/Public/16MarTxFloods/TxCAP/20160313/SabineRiverVIRB_B/SabineRiverVIRB_B_20160313_VIRB0481.JPG





CAP March 14, 2016



Date/Time 2016-03-14 18:29:44
Altitude 20 meters above sea level
Latitude N 30 deg 17'38.4
Longitude W 93 deg 45'8.4

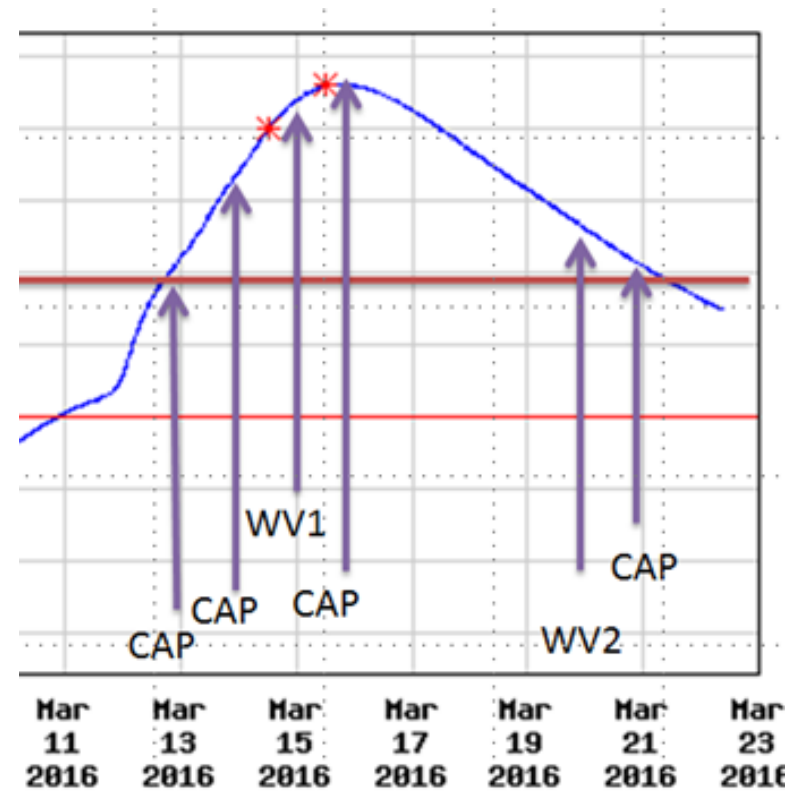
[Get Full Size Image](#)



March 15,
2016 WV1



CAP March 16, 2016



Date/Time 2016-03-16 12:33:41

Altitude 289 meters above sea level

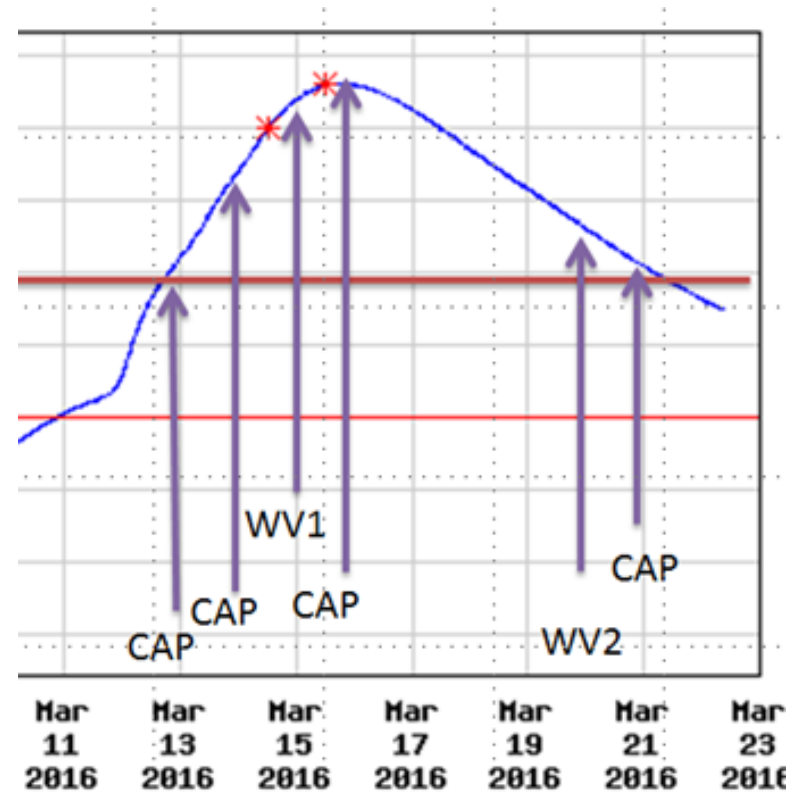
Latitude N 30 deg 17'40.698

Longitude W 93 deg 44'58.104





March 20, 2016



Date/Time 2016-03-20 09:50:37

Altitude 300 meters above sea level

Latitude N 30 deg 17'43.362

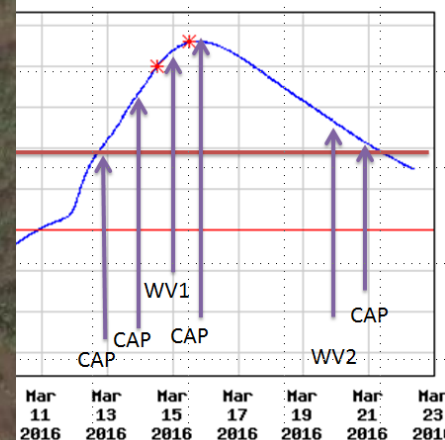
Longitude W 93 deg 44'53.154

[Get Full Size Image](#)





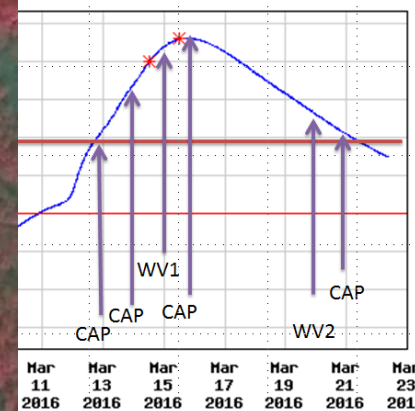
March 20, 2016



@ 2016
DigitalGlobe
NextView
License

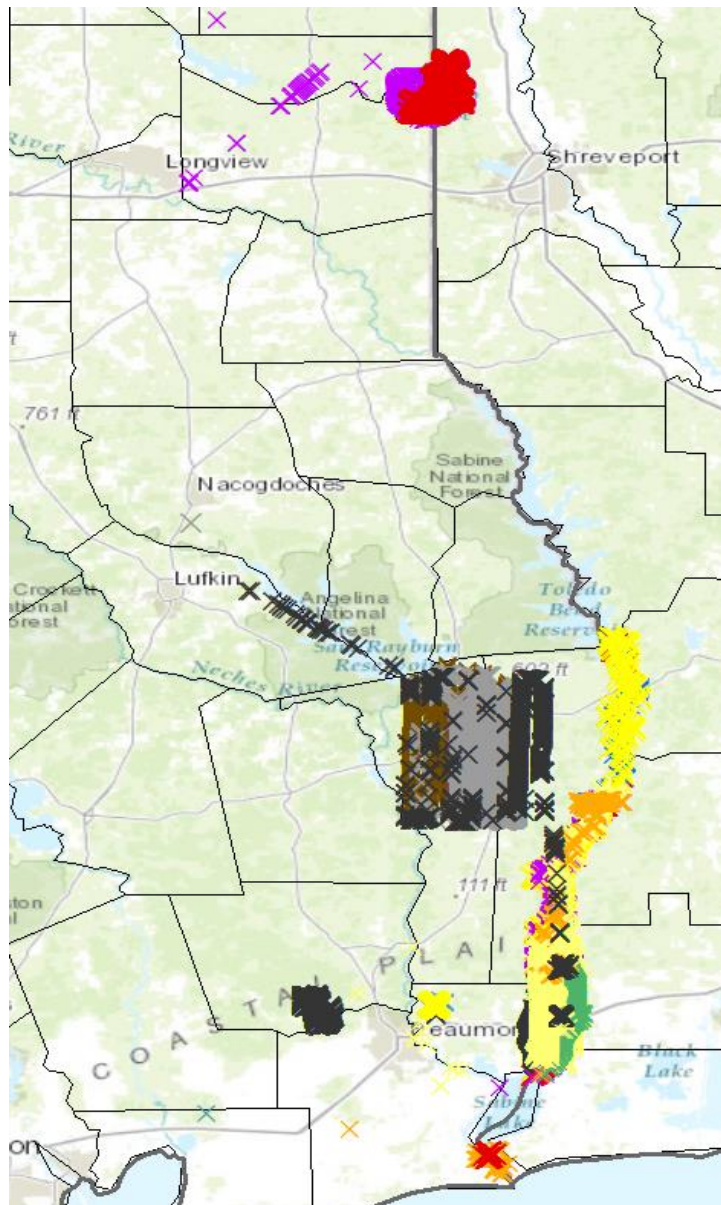


March 20, 2016



@ 2016
DigitalGlobe
NextView
License

Texas Civil Air Patrol acquired 18,514 images to monitor flooding in March 2016



USDA Disaster and Crop Insurance

Imagery is needed for rapid assessment of the disaster situation.

- To locate erosion problem areas and implement conservation practices to protect soils and water.
- During and after disasters, farmers are eligible for disaster, conservation and insurance payments.
- Imagery helps maintain program integrity.
- When dealing with large events, such as the southern US floods in March 2016, large areas of rural America is impacted.

Content Provided by

- Tony Kimmet, NRCS
- Dorsey Plunk, NRCS
- Everett Hinkley, FS
- Melinda McGann, FS
- Craig Molander, Surdex